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AN EXPLORATORY STUDY OF THE RELATIONSHIP BETWEEN EDUCATIONAL
EXPENDITURE AND CERTAIN MEASURES OF ACADEMIC
ACHIEVEMENT IN A SAMPLE OF ALBERTA SCHOOLS

by



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A THESIS

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ABSTRACT

The purpose of this study was to examine and analyze the relationship between educational expenditure and academic achievement in a sample of Alberta schools in 1970-71. Data for the analyses were obtained from various federal, provincial and municipal sources.

An input-output relationship was used in the study for the conduct of the empirical phases of the analyses. The input-output relationship classified the independent variables into two theoretical categories: non-policy and policy variables. Non-policy determinents were viewed as being less susceptible to short-run manipulation by policy-makers. In contrast, policy variables were viewed as being capable of short-run manipulation. The distinction between policy and non-policy independent variables provided a logical basis for separating statistically synonymous variables for the purposes of the empirical analyses.

The empirical analyses examined the relationship between academic achievement and non-policy independent variables using a one-way analysis of variance and the relationship between academic achievement and policy independent variables using an analysis of covariance statistical technique.

The non-policy variables were of the greatest importance in determining the differences in school output

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CHAPTER I

THE PROBLEM AND DEFINITION OF TERMS

I. INTRODUCTION

Rapidly escalating costs and growing competition for public revenues has provoked many educators, researchers, and laymen to search for a more effective and, hopefully, more efficient form of public schooling. This endeavor stems from the belief that academic achievement in schools is closely related to the level of in-school expenditure. While some researchers hold that the improvement of education is a product of the inextricable link between academic achievement and additional financial support for schools (Mort, 1952; Barren, 1957), there have emerged opposing views to this claim in recent years. Coleman (1966), and Burkehead et al. (1967) have taken exception to the use of expenditure levels as gross measures of in-school academic achievement. Coleman's findings led him to conclude that:

Taking all these results together, one implication stands out above all: That schools bring little influence to bear upon a child's achievement that is independent of his background and general social context; and that this very lack of independent effect means that the inequalities imposed upon children by their home, neighborhood, and peer environment are carried along to become the inequalities with which they confront adult life at the end of school (1966:325).

Such findings raise difficult questions for educators. If increases in per pupil expenditure, higher teacher salaries,

and a number of other traditional remedies often prescribed to overcome low scholastic achievement have, in fact, virtually no effect, what grounds are there to press for increased funds for education?

To explore more accurately the relationship between academic achievement and expenditures, it is necessary to examine not the level of inputs alone, but how these inputs are allocated within the school system. Thus, one is led to consider questions such as:

1. What is the most effective allocation of resources between human inputs and technological inputs?
2. Is the sum and type of expert staff indicative of improved achievement?

The growing desire for accountability in public schools as well as the increasing expenditures of school systems has emphasized a need for more critical empirical evidence as to what, if any, relationship exists between variables associated with the expenditure of school operation and the academic achievement of students.

II. STATEMENT OF THE PROBLEM AND SUB-PROBLEMS

Problem

The major purpose of this study is to examine the relationship between academic achievement as measured by the Alberta grade nine Department of Education's tests and selected policy and non-policy variables associated with the

expenditures for school operation in a sample of schools in Alberta.

General Sub-Problems

As a consequence of the major problem, two general sub-problems are investigated. These are:

1. What relationship exists between academic achievement as measured by the Alberta Department of Education grade nine tests and certain non-policy variables associated with the expenditure for school operation in a sample of Alberta Schools?
2. What relationship exists between academic achievement as measured by the Alberta Department of Education grade nine tests and certain policy variables associated with the expenditure for school operation in a sample of Alberta schools?

Specific Sub-Problems Relating to Non-Policy Variables

The following eight sub-problems relating to non-policy variables in the sample of Alberta schools are examined:

1. What relationship exists between academic achievement and the percentage of the pupils of British ethnic origin?
2. What relationship exists between academic achievement and the religion of the pupils?
3. What relationship exists between academic achievement

and urbanization?

4. What relationship exists between academic achievement and district equalized assessment per pupil?
5. What relationship exists between academic achievement and the mean family income?
6. What relationship exists between academic achievement and the scholastic ability of the pupils?
7. What relationship exists between academic achievement and the supplementary requisition per pupil?
8. What relationship exists between academic achievement and the mean age of the pupils?

Specific Sub-Problems Relating to Policy Variables

The following eighteen specific sub-problems related to policy variables are examined:

1. What relationship exists between academic achievement and the mean salary of grade nine teachers?
2. What relationship exists between academic achievement and expenditure for internal school administration per grade nine pupil?
3. What relationship exists between academic achievement and expenditure for special staff within the school per grade nine pupil?
4. What relationship exists between academic achievement and expenditure for support staff within the school per grade nine pupil?

5. What relationship exists between academic achievement and expenditure for central office administration per grade nine pupils?
6. What relationship exists between achievement and expenditure for central office specialist staff per grade nine pupil?
7. What relationship exists between academic achievement and direct instructional expenditure per grade nine pupil?
8. What relationship exists between academic achievement and operational expenditure less direct instructional expenditure per grade nine pupil?
9. What relationship exists between academic achievement and non-personel expenditures per grade nine pupil?
10. What relationship exists between academic achievement and pupil-teacher ratio in grade nine?
11. What relationship exists between academic achievement and average grade nine class size?
12. What relationship exists between academic achievement and school pupil population?
13. What relationship exists between academic achievement and number of pupils in grade nine?
14. What relationship exists between academic achievement and years of training of grade nine teachers?
15. What relationship exists between academic achievement and average numbers of years of experience of grade

nine teachers?

16. What relationship exists between academic achievement and number of courses taught in grade nine?
17. What relationship exists between academic achievement and grade nine teacher-turnover ratio?
18. What relationship exists between academic achievement and the grade organization within the school.

III. JUSTIFICATION OF THE STUDY

In the context of this study, effectiveness may be defined in terms of those educational resources which are significantly related to educational outputs. Many of the reasons for the investigations of effectiveness of school inputs develop from the fact that resources are scarce, i.e., if free, their demand would exceed supply and their use for one purpose would exclude their use elsewhere.

Education expenditures in Canada have risen substantially in the past decade, and there are many indications that the upward spiral of per capita educational costs is likely to continue through the next decade. Hanson (1969) reports that the increase in expenditure during the three year period 1965-68 was 16.5 per cent. Further, Hanson (1969) predicts that ". . . Expenditure in education in Canada will continue to increase substantially during the 1970's."

Thomas (1963) made a similar prediction when he stated that several factors will cause a continued increase

in the demand for educational resources. These include the following: greater social value placed on school attendance, demand for a higher quality education, technological advances which require well educated personnel, and maintenance of economic growth.

At the present time Canadian educational systems are under considerable pressure to justify existing and proposed expenditures. Hanson (1970) writes:

In the field of public education, government will make increasingly close and detailed studies in order to demonstrate benefits and costs because of the large proportion of public funds which is being devoted to this function.

Therefore, as this study examines the relationships between expenditure and achievement of schools, the fundings should be particularly relevant.

An example of this trend in Alberta is the development of a planning, programming, budgeting and evaluation system which is presently in operation as a pilot project in ten school jurisdictions. The initial phase of the project is limited to accounting practices but, to be considered useful, it will require an evaluation of the effectiveness and efficiency of the school systems in relation to expenditures. To date, the output aspect of PPBES has been studiously avoided because of the difficulties involved. A study of this nature is relevant to the PPBES project as it may establish the presence or absence of a statistical relationship between expenditures and scholastic achievement

in Alberta schools at the grade nine level.

In North America, a public education system appears to meet with general approval and many people are in favour of improving the public education system. A principle which has gained wide acceptance is that money and effort spent on education is money and effort well spent; an investment in human resources that will pay high dividends not only in terms of economics but in human happiness and well being. Furthermore, some political scientists have claimed that adequate education is a citizen's inherent right and that the effect of conferring this right will make that democracy more secure, meaningful and more capable of solving its problems (Kirk, 1968).

The child's right to the best education available appears to be an entrenched right which few would dare to challenge. This philosophy indicates a concern with the schools' effect on the student and society. This is in keeping with the recent literature on the equality of educational opportunities which stresses the examination of educational consequences or outputs.

Finally, this is one of the first Canadian research projects which studies expenditure and achievement of schools using achievement as a measure of output, while at the same time attempting to control statistically for pupil intelligence and socio-economic characteristics of the students. Although there have been a number of similar studies in the United States, which have found few effective school

components, results of empirical studies based on United States data are not necessarily applicable to Canada. There is a need for the United States results to be verified or rejected using the Canadian data. The need for Canadian educational research is reinforced by Moffatt whose comment made in 1957, continues to be applicable:

. . . We need, first of all, more reliable information on the financing of our schools and on public finances in general. much of this information must come from research conducted in Canada and applied to Canadian conditions. Nearly all the research quoted or referred to in these lectures has been conducted in the United States while conditions may not be very different and while the conclusions reached may be very much the same the fact that the research uses our own data will make its findings much more convincing (1957:89-90).

There is a present need for, and in all probability an increasing need for, examination of the relationships between educational inputs and outputs to give a more comprehensive understanding of the nature of the inputs' influence in producing desired student capabilities.

The study should add to an increasing body of research results on expenditure of schools using achievement as a measure of output. Moreover, the study uses the school as the basic unit of study. This prevents some of the "averaging out" of many previous research projects which used the school district rather than the school as the basic unit of research. The study may be considered as a heuristic exercise in the area of the output of education. Its goal is simply to add to our knowledge of the inputs that make for educational achievement variations.

IV. DELINEATION OF THE STUDY

Delimitations

1. The study is delimited to 3576 grade nine students from 44 selected schools in ten school jurisdictions in Alberta in 1970-71.
2. The study will be limited to expenditures and achievement for the school year 1970-1971.

Limitations

The study is limited by the accuracy and completeness of the data provided by the sources of data. Furthermore, because the study focuses on grade nine students in 44 schools in Alberta in one year, caution should be used in generalizing the findings of this study. Additional studies would be necessary to make such an application valid.

Assumptions

1. There is a relationship between the dependent variable and the independent variables.
2. The Alberta Department of Education academic achievement tests are good measures of achievement in grade nine.

V. DEFINITION OF TERMS

Certain terms are used in a restricted sense in this investigation. In order to provide a concise understanding of the scope and its limits of this study these

terms are defined below:

Achievement

Achievement is defined as the mean total score in social studies, science, mathematics, language arts, and reading on the Alberta Department of Education grade nine tests obtained by the selected pupils in 1970-71.

Ethnicity

Ethnicity is defined as percentage of pupils of British origin.

Mean Age of Pupil

This term is defined as the mean age of the pupils selected for this study.

Urbanization

The term is used to indicate whether or not the pupils attending each of the schools live in an urban place. An "Urban place" is defined as a city or town with a total population of 10,000 or more. These areas, as defined in the census, relate to groups of urban communities which are in close economic, geographic, and social relationships.

Assessed Value of Property

The Alberta provincial equalized assessment of real property for taxation purpose.

Scholastic Ability

The scores obtained by the grade nine pupils in the

selected samples on the 1971 Alberta Scholastic Ability Test are used as the measure of scholastic ability.

Educational Expenditures

The total operating expenditures which include expenses for administration, instructional aids and supplies, instructional salaries, auxiliary services, plant operation and maintenance, transportation of students, debt services and miscellaneous factors. The expenditures incurred for capital construction are omitted.

Direct Instructional Salary

That portion of a teachers' salary allocated to the scheduled teaching of assigned classes of students.

Policy and Non-Policy Variables

The distinction between policy and non-policy variables rests on the essential point that the former are very much more susceptible to influence by policy makers than the latter. Each of the policy factors is capable of some manipulation in contrast to the relatively static nature of non-policy factors.

School Population

This term indicates the number of pupils who attend each school selected for the sample.

Teachers' Training

For the schools in the sample, teachers' training is

defined as the number of years of professional and academic training beyond grades twelve.

Support Staff

This term includes all clerical and secretarial personnel and other technical staff. Groundkeepers, transportation personnel and maintenance personnel are not included.

Special Staff

This term includes all guidance counselors psychologists, reading consultants, and all other pupil-oriented consultative personnel.

Administrative Staff

Based on the review of the literature, administrative staff is defined to include all personnel who:

1. Plan, organize, direct, coordinate, and control the activities and personnel of a school district.
2. Makes key organizational decisions.
3. Supervise the work of other personnel, and
4. Do not work directly with pupils or their instruction.

Teacher-Turnover Ratio

Was defined as the number of teachers who resigned in June 1971 as a proportion of the total number of teachers in the school in 1971.

CHAPTER II

REVIEW OF THE LITERATURE ON EXPENDITURE AND ACHIEVEMENT

I. INTRODUCTION

The particular purpose of this section is to examine the previous studies within which the empirical phase of the study can be cast. Hence, the main part of this chapter is devoted to brief reviews of salient features of the related studies. Thorough reviews of major empirical studies relating to achievement and effective characteristics of schools have been given by Mort, 1952; Barren, 1957; and Guthrie, 1970. Therefore, only the highlights of recent empirical studies are given to provide a perspective within which to view the findings of this study.

II. ACHIEVEMENT IN EDUCATION

There should be no illusion that achievement tests measure the output of education in a complete sense. Nevertheless, it is believed that enough of the output is measured to give meaningful direction to the making of educational policy (Kiesling, 1965:10). From this it might appear that exceptions can be taken to the use of achievement tests on two fundamental grounds. Firstly, that there are more dimensions to public education than learning in the basic subjects, and, secondly, the achievement tests do an incomplete

job in measuring learning in these basic subjects. However, a substantial body of literature does exist which mitigates the seriousness of both of the above claims. A number of writers have indicated that achievement in the basic subjects is indicative of scholastic performance in general. Although performance tests themselves are prone to adverse criticism, the major criticisms are directed at the incorrect interpretation of test results.

Furthermore, parents and schools place a certain level of dependence on achievement tests as measures of past success and indicators of future performance. Criticisms of testing appear to be directed at incorrect interpretation of test results rather than at the tests themselves. (Thorndike and Hazen, 1961; Adkins, 1947; Hoffman, 1962). It is also true that a number of writers believe that achievement in the basic subjects is a good key to basic performance (Kershaw, and McKeen 1959; Coleman, 1966; Goodman, 1959; Benson, 1965, Guthrie, 1970).

A variety of achievement tests are used for school and college placement as well as for job placement. These tests are designed to measure some of the major skills necessary for further education and for occupational advancement in modern society. Coleman, (1966;218) stated that "the facts of life in modern society are that intellectual skills, which involve reading, writing, calculation, and analysis of information are becoming basic requirements for independence, for productive work, for political participation, and for wise consumption." Thus, while such tests are

not the only thing educators mean when they speak of outcomes of schooling, they are a large and an important part of it.

III. EXPENDITURE-ACHIEVEMENT RELATIONSHIPS

A number of expenditure studies have been designed to examine the gross relations between dollar inputs and educational outcomes. While only a few studies have been carried out using educational achievement as a measure of effectiveness the general approach has been pursued for at least three decades.

IV. EXPENDITURE STUDIES USING INPUT AS A MEASURE OF SCHOOL EFFECTIVENESS

Early research studies concerning school effectiveness were conducted for the most part by professional educators. This work is best characterized by the "cost-quality" studies of the late Paul R. Mort (1952). Mort (1952) and Barren (1957) provide reviews of the literature on this type of study. The general mode of previous research involved the use of per pupil expenditure levels as gross measures of the quality of a school. Some researchers (Bowles and Levin, 1968; Guthrie et al., 1970) claim that for a number of reasons, such studies shed little light on the variables which are measures of effective school inputs. First, expenditures are an aggregate dollar amount that does not reflect the level or nature of educational resources being used for a measure

of school effectiveness. Thus, it is impossible to assess the effect of various policy variables on achievement in education. Secondly, inconsistencies among school districts in accounting procedures as well as imprecise survey questions on expenditure have likely led to important measurement errors in several previous studies.

In more recent work, such as that of Furno (1956), assessment of school effects stopped short of pupil achievement and took, instead, some process variable such as the rate of which schools adopted innovative instructional practices or new curricula. These studies rather consistently concluded that those districts or schools which spend the most money were the most effective schools, on the premise that school effectiveness was equated with school expenditures.

In addition to the measurement problems regarding input, there was a lack of quantitative data on educational outcomes. Furthermore, there was not sufficient consideration of the pupils' capabilities prior to school entry, the type of experience participated in outside the school, or the socio-economic background. Thus, the common finding that high expenditure districts produced large numbers of high performance students was not surprising since such schools or school districts were often associated with high socio-economic groups or districts. In these situations, the educational advantages of the students, by virtue of the home environment and community setting, is substantially high and, as a result, the students have a distinct advantage within a

school system (Olim, et al., 1967;414-424). Levin stated that: "while the early expenditure and achievement studies are provocative when placed in historical perspective, they cannot provide an empirical basis for improving our understanding of the effect of educational expenditures on school outputs" (Levin, 1970:186).

V. EXPENDITURE STUDIES USING OUTPUT AS A MEASURE OF EFFECTIVENESS

In recent years, an increasing body of sophisticated research has accumulated on the effectiveness of various school components. The recent studies have examined the relationship between school expenditure and student achievement scores while attempting to control differences in intelligence and the socio-economic background of the students.

Mallenkoph and Melville (1956) gathered aptitude and achievement test scores from a nation-wide sample of 9,000 ninth grade students and 8,357 twelfth grade students in 106 American schools. Thirty-five variables dealing with socio-economic characteristics of the students and their parents, availability of community educational opportunities and the characteristics of available school services were identified. The authors reported four school service measures to be significantly related to pupil achievement. These were: (1) number of special staff, (2) class size, (3) pupil-teacher ratio, and (4) instructional expenditures per student. All the findings suggested the central importance of school staff,

special services and frequent pupil contact with the staff. In addition, the findings indicated that the four measures cited above would require a higher expenditure outlay in order to bring about higher achievement.

Comparable findings on two dimensions were reported by Goodman (1959) as a result of the "Quality Measurement Project" in New York. Goodman reported per pupil expenditures and the number of school staff to be significantly correlated with achievement test scores of grade seven students. In addition, Goodman found teachers' experience and a variable described as "classroom atmosphere," a measure resulting from an observer's rating to the degree to which teachers were pupil-oriented as contrasted with what educators frequently term "subject-matter oriented," as significant. The latter variable may have been a very subjective measure. In general, Goodman's findings point to the importance of the school's personnel in the instructional process.

Thomas (1962) utilized Project Talent information to test the importance of a large number of home, community, and school service variables upon student performance by means of regression analysis. Of these many variables, three measures of school services were found to be significantly related to student test scores after taking home and community factors into account. The school service components were: (1) beginning teachers' salaries, (2) teachers' experience, and (3) number of volumes in the school library, of which (1) and (2) were closely interrelated.

In 1959, Green studied a Virginia school system in which the schools were closed to avoid the United States Supreme Court racial desegregation decree. Using a pre-test and post-test to measure achievement Green and his team of researchers found significant differences in test scores of pupils who attended voluntary classes during this time and those students who did not attend the voluntary classes. Only the most gross kind of statement can be made in interpreting this research: Those children who attended the intensive volunteer classes scored higher than those who did not attend the classes.

Two important studies related to achievement were reported in 1965 by Herbert J. Kiesling in New York and by Charles S. Benson in California. The results of the two studies were similar in as much as both researchers found expenditure for instruction to be significantly related to student achievement. Benson found teachers, salaries, administrators, salaries, and instructional expenditures to be significantly related to student test scores. In that the total per pupil expenditure figure for a school district represents money spent for a wide range of products and services, it is impossible to state precisely from Kiesling's findings just what school service component or components make the difference. One explanation which appears reasonable, however, is that the expenditure for personnel is important since this figure typically accounts for 65 to 85 per cent of the school budget, thus the higher the expenditure the higher

is the ability to purchase higher quality personnel. These increments in staff reflect themselves in the achievement test scores of the students. This is but a supposition, however, because Kiesling does not present data directly related to teacher preparation and experience.

As Benson and Kiesling are careful to suggest, the opportunity exists for various kinds of measurement distortions in the two studies because district-wide average figures are used for expenditure. The data used could distort significantly the results because of "averaging" which occurs when measures for an entire district are used.

The most significant school service variable found by Coleman in his 1966 study was the teacher characteristic, verbal ability. Care must be used in interpreting the meaning of such a result. What Coleman reports is, that after having made an effort to control statistically for a student's home background and community social environment, his marks on a vocabulary test tend to improve in relation to the verbal ability of his teacher. The verbal ability of the teacher was also measured by a vocabulary test. Obviously, much more is involved in the instruction of a student than his teacher's skill at responding to verbal ability test questions. However, if one views teacher's verbal ability as a proxy measure for a number of related skills and qualities, the Coleman report finding can be interpreted in a meaningful fashion. The findings can be construed to mean that an intellectually facile instructor is more adept at tasks, such

as finding means to motivate students, adapting materials to their ability levels, and communicating in ways which make the subject matter more understandable. This interpretation appears to be consistent with observations and conventional wisdom.

In the year following the publication of the Coleman Report, three additional studies were published which dealt with some facet of expenditure and achievement in schools. Shaycroft (1967) concentrated on school-related subjects, subjects about which one typically does not learn outside of school. Thus, the room for alternative explanations of achievement gains was reduced. The Shaycroft study revealed that statistically significant gains were made by the students selected for the study. This was so even when differences in socio-economic status were controlled statistically. It is reasonable to infer from such a finding that for the schools in question, some school services characteristics are influencing student achievement in subjects not part of the curriculum. No measures of components such as staff quality, instructional material availability, or equipment and facility adequacy were employed. What can be said is that the availability of a particular curriculum in a school is related significantly to achievement in general.

Burkhead (1967) studied a sample of 39 Chicago public secondary schools and 22 Atlantic high schools in an attempt to find measures of effective school inputs. Statistical techniques were employed in an effort to control

for the socio-economic status of students, but the report used the same statistical procedures as the Coleman report and thus, according to many authors (Levin, and Bowles, 1968; Wertz, 1969), the report tended to understate the impact of school service components. With this possible understatement of the impact of school inputs, Burkhead still reported the following school services to be effective as indicators of increased achievement: (1) age of building, (2) teachers' experience, (3) teacher turnover, and (4) teachers' salary.

Peaker (1967), in a section of the Plowden Report, written as a result of a study conducted in England, described findings which were not very different from those which accompanied the Coleman Report. Nevertheless, several school service components were described as contributing in a statistically significant fashion to an explanation of pupil achievement. Two of these components, age of building and teachers' experience, were similar to the findings of Burkhead (1967). Academic preparation of teachers and teachers scholastic 'ability' were the other two school service inputs found to be statistically significant. These findings are all consistent with and reinforce the findings of the studies cited above.

Added evidence of the significant role played by the teachers in the instructional process is provided by Cohn (1968). Using multiple regression analysis, Cohn reported that the amount of teachers' salary, the number of instructional assignments per teacher, and school size were associated with

increments of pupil achievement, and the direction of the association was positive.

Raymond (1968); Katzman (1968); Bowles (1968); Bowles (1969); Bowles and Levin (1968); Hanushek (1968); Ribich (1968) and Guthrie (1970) found somewhat similar findings to those reported above. Variables found to relate significantly to students' performance, which were not reported in earlier research, were ability grouping in Bowles (1968), school site size, percent of the classrooms which are makeshift, textbook supply, teacher's job satisfaction, and the percent of students transferring in Guthrie (1970).

VI. CANADIAN STUDIES

Canadian research in the area of input-output relationships in education is meagre and concentrates upon intra-provincial comparisons. However, some effort has been made to document the relationship between input and output in Canadian education.

Cheal (1963) made a study which dealt with school input and output difference. The study, although limited in its variety of input and output variables, does provide some evidence as to what types of factors have an influence on educational output.

Pupil retention rate was the only measure of school output employed by Cheal. Cheal discovered that there were sizable variations in retention rates among the ten provinces.

For grades two to eleven, the average retention rate ranged from 35 per cent in the Maritimes to 55 per cent in the four Western Provinces. Cheal also found large disparities with regard to educational inputs. Per-pupil expenditure figures indicated that some provinces were spending 2.5 times as much as other provinces and per-pupil expenditures, salaries, and other expenditures, showed large variations among the provinces. In addition to the above findings Cheal indicated that socio-economic differences among provinces were significantly related to inputs and outputs of education.

John Porter (1965) conducted a study in which he examined the way in which education as a scarce resource, which costs money, is distributed through the class structure. Porter stressed social and psychological impediments to education. Of the social barriers to educational output he considered lack of income as a serious factor, but he also stated that psychological barriers may have prevented many from choosing more education even if education had been free. The desire to stay in school and achieve well academically is related, principally, to the socio-economic characteristics of the family. He added that wealthier families could not only afford to keep their children in school, but could also foster the transmission of education's worth to their children.

After completing a study conducted in Ontario, Fleming (1957) reported that the socio-economic characteristics of the family were very important to the success of

students in Ontario's schools. He found that there was a significant relationship between the level of a community's socio-economic development and the interest and achievement of its students. The greater the wealth the higher the interest and the better the achievement.

A considerable amount of selection had already taken place in the early school years on the basis of factors associated with high socio-economic status.

Schaafsma in a study of demand for higher education in 174 cities in Canada with a population over 10,000, concluded that the three variables which reflected socio-economic background of those people (in 18-24 age category) explained about 84 per cent of the variance in the dependent variable (the probability that the people in the age category 18-24 would attend university). Obviously this study indicates the importance of socio-economic background in determining the output of schools when this output is measured in terms of the demand for post secondary education in Canada.

VII. ALBERTA STUDIES

A number of Alberta studies have dealt with the relationship between training and experience of teachers and achievement in the subject area. Bodnaruk (1962); Strandberg (1966); and Klufus (1964) did not find significant relationships between pupil achievement and the total length of professional training of teachers. On the other hand,

Lindstedt (1966); Eddy (1962); and Tetley (1964) did find some significant relationships between pupil achievement and professional training when the training exceeded four years. Findings with regard to teacher experience, did not appear to be conclusive. It should be noted that the studies do not control for pupil's intelligence, or socio-economic characteristics of the students. In addition, the input and output variables were extremely limited.

VIII. SUMMARY OF EFFECTIVENESS STUDIES

Investigations of school effectiveness have been conducted using a wide variety of sample subjects, input and output measures, and controls for what are commonly presumed to be out-of-school influences on pupils were significant in most if not all the studies. The essential components of each expenditure effectiveness investigation studied are presented in Table 1. The relationship between school output and resource input was disappointingly weak in many of these studies.

Inspection of the results leads to the conclusion that there is a substantial degree of consistency in the several findings. The strongest findings are those which relate to the number and characteristics of the professional staff, particularly teachers. Fifteen of the studies find teacher characteristics to be significantly associated with one or more measures of pupil performance. Many of the

TABLE I

SUMMARY OF EFFECTIVENESS STUDIES ON SCHOOL SERVICE COMPONENTS

Study Author(s)	Description of Sample	Measure of Pupil Performance (School Output)	Measure(s) of Effective School Service Component(s) (School Input)
Mollenkopf and Melville	U.S., 17,000 9th (in 100 schools) and 12th (in 106 schools) grade, male and female.	Aptitude and Achievement Tests	1. Number of special staff 2. Class size 3. Pupil-teacher ratio 4. Instructional expenditure
Goodman	New York, 70,000 7th and 11th grade, male and female in 102 school districts	Achievement Test	1. Number of special staff 2. Instructional expenditures 3. Teachers' experience 4. Classroom atmosphere
Thomas	Project TALENT Sample (national) 10th and 12th grade, male and female	Achievement Test	1. Teachers' salaries 2. Teachers' experience 3. Number of library books
Green, et al.	Virginia (primarily Negro) Secondary students	Stanford Achieve- ment Test	1. Aggregate measure of entire instructional program
Benson	California 5th grade, 249 school districts	Reading Achieve- ment Test	1. Teachers' salaries 2. Administrators' salaries 3. Instructional expenditures

TABLE I (continued)

Study Author(s)	Description of Sample	Measure of Pupil Performance (School Output)	Measure(s) of Effective School Service Component(s) (School Input)
Kiesling	New York, 70,000 7th and 11th grade nine male and female in 102 school districts	Achievement Test	1. Expenditure per pupil (in large school districts)
Coleman Report	U.S. sample	Verbal Ability Test	1. Teachers' verbal ability
Shaycroft	U.S. 108 schools 65,000 9th and 12th grade, male and female	Battery of 42 Aptitude and Achievement Tests	1. Curriculum variables
Burkehead	90,000 Chicago High School students in 39 schools. 19,000 Atlanta High School students in 22 schools and 180 small community high schools	Aptitude and achievement Tests and School Holding Power	1. Age of building 2. Teachers' experience 3. Teacher turnover 4. Teachers' salary
Plowden Report	English Elementary School students	Achievement Test	1. Age of building 2. Teachers' academic preparation 3. Teachers' experience 4. Teachers' ability

TABLE I (continued)

Study Author(s)	Description of Sample	Measure of Pupil Performance (School Output)	Measure(s) of Effective School Service Component(s) (School Input)
Cohn	Iowa High School students in 377 school districts	Achievement Test	1. Teachers' salary 2. Number of Instructional assignments per teacher 3. School size
Raymond	W. Virginia 5,000 high school students	Freshman Year (college) GPA and Achievement Test Scores	1. Teachers' salary
Katzman	Boston Elementary School Students	School Attendance Sch. Holding Power Reading Achievement Special School Entrance Exam.	1. Pupils per classroom 2. Student-staff ratio 3. Attendance district enrollment size 4. Teachers' employment status 5. Teachers' degree level 6. Teachers' experience 7. Teacher turnover ratio
Bowles (1)	U.S. 12th grade Negro males	Verbal Ability Test	1. Verbal ability of teachers 2. Ability grouping 3. Level of teacher training 4. Age of school building 5. Expenditures per pupil

TABLE I (continued)

Study Author(s)	Description of Sample	Measure of Pupil Performance (School Output)	Measure(s) of Effective School Service Component(s) (School Input)
Bowles (2)	U.S. 12th grade Negro males	Mathematics and Reading Achievement Test and a test of general academic ability	1. Class size 2. Ability of grouping 3. Level of teacher training 4. Age of school building 5. Expenditures per pupil
Bowles and Levin	12th grade White students and 12th	Verbal Ability Test scores	1. Teachers' verbal ability 2. Teachers' experience
Hanushek	6th grade white students in 471 schools and 6th grade Negro students in 242 schools	Verbal Ability	1. Teachers' verbal ability 2. Teachers' experience
Ribich	Project Talent sample	Achievement Test	1. Expenditures per pupil
Guthrie, et al.	5,284 6th grade students in Michigan	Reading Ability Mathematics understanding. Verbal facility	1. School site size 2. Building age 3. Percent classrooms makeshift 4. Library volumes 5. Textbook supply 6. Teachers' verbal ability 7. Teachers' experience 8. Teachers' job satisfaction 9. School size (enrollment) 10. Classrooms per 1,000 stud. 11. Percent of students transferring

findings also note a statistically significant relationship to contact frequency of students with professional staff. In addition to findings in support of the effectiveness of the staff, a number of studies present results to suggest that certain aspects of school physical facilities are significantly linked to pupil achievement. Because all the foregoing components translate into dollar costs, measures such as expenditure per pupil, and teachers' salary levels correlate significantly with pupil achievement measures.

CHAPTER III

VARIABLES AND TECHNIQUES

I. INTRODUCTION

Section II of this chapter deals specifically with the school sample and the criteria for its selection. Section III is devoted to variable selection and data sources. Data analysis techniques are considered in Section IV, particularly those related to analysis of variance and covariance.

II. DESCRIPTION OF THE SAMPLE

The nature of the study required a sample of schools which present a representative cross-section of conditions of school operation accompanied by specific and detailed expenditure data for specific grade levels in each of the schools. The Alberta Department of Education, in selecting school systems to participate in the PPBES Pilot Project for 1971, used a set of criteria which was suitable for the present research. The specific criteria employed were:

1. Size by pupil enrollment, teachers and schools.
2. Type by urban and rural, county, division, city and small independent.
3. Geographic distribution
4. Accounting capability
5. Evidence of a management team comprising of the

superintendent, secretary treasurer, and trustees in addition to willingness by management to involve educational administrators and teachers.

6. Willingness and ability (of those participating) to provide leadership in implementing a PPBE system in similar jurisdictions in their zones and the province. (PPBES Pilot Project, 1971).

In addition, the organizers of the pilot project made available, for purposes of this research project, certain specific data regarding expenditures for education at any grade level in each of the school jurisdictions under consideration. Although 1971 expenditure data is available for any grade in the PPBES Project, the sample for this study is limited to grade IX level since it is the only grade in which standardized tests are commonly available in Alberta. These are used as measures of output. On the basis of the data requirements the sample was limited to 44 schools which have grade nine level of education within the ten jurisdictions selected for the PPBES Project. These schools were selected from the following ten jurisdictions:

1. Calgary Separate District No. 1
2. Edmonton Public School District No. 7
3. County of Beaver No. 9
4. County of Mountain View No. 17
5. County of Red Deer No. 23
6. Pincher Creek School Division No. 29
7. Lethbridge Public School District No. 57

8. Salisbury School District No. 105
9. Grand Prairie Public School District No 2357
10. Lac La Biche School Division No. 51

III. THE DEPENDENT VARIABLE

The selection of an explicit measure of academic achievement for use as the dependent variable is not for-ordained. Previous empirical studies have worked mainly with academic achievement as a measure of output. It would appear that at this time there is general accord about the necessity of restricting the dependent variable to academic achievement. Thus, the dependent variable used in this study is the mean score on the Alberta Department of Education grade nine tests administered in each of 44 schools in 1971. The tests were conducted in Social Studies, Science, Mathematics, Language Arts, and Reading. The mean score on the tests of the above subjects will be the measure of output in an input-output relationship. Statistically, the mean academic achievement score on the accumulated subject test results in the 44 schools is the dependent or criterion variable in the analyses.

A wide variety of literature exists concerning scores on achievement tests, but a thorough discussion on the topic of achievement scores would go considerably outside the limitations of this study. It should be emphasized that no claim is being made that achievement scores capture the whole of educational quality. It is assured, however, that

achievement tests capture a large enough part of the educational quality dimension to be useful to policy makers. A similar position was taken by Kiesling (1965) and Kershaw and McKeen (1959). The goal of obtaining high test scores is seen by many as basic to the promotion of effective participation in our society. Coleman (1968) for instance stated that ". . . a pupil's test results provide a good measure of the range of opportunities open to him as he finishes school . . . a wide range of choices of jobs or colleges if these skills are very high; a very narrow range that includes the most menial jobs if these skills are very low."

Achievement tests have been under constant critical evaluation and improvement for more than 35 years and their widespread use bears witness to their utility as a measuring device. The Alberta Government Department of Education grade nine tests in the various subjects are used for school placement as well as an education measure. These tests are designed to measure some of the skills necessary for further education and for occupational advancement in society.

In sum, the Alberta grade nine achievement tests appear to be well developed to provide a very useful measure of achievement performance--certainly better than any readily available alternative.

IV. INDEPENDENT VARIABLES

In the context of this study inputs or independent variables are those elements within the school or school district believed to relate to academic achievement, the dependent variable. The range of these elements is quite broad, including the schools' environmental setting and physical characteristics.

The section of input variables is complicated by the lack of a good instructional theory, which would allow for manipulation of the physical and mental elements and suggest how they might be adjusted to maximize benefits to the students involved (Hill, 1964; 27-53).

There has been scant use made of any logically developed input-output relationship to act as a guide for the selection of input and organizational variables as determinents of educational achievement. The input variable selection for this study has, in the absence of an adequate instructional theory, been largely derived from previous research, from deductive logic, and from attention to the types of statistical techniques to be performed.

The input measures which are included in this study attempt to reflect important factors in the educational environment. The lack of a theory of instruction, however, will continue to limit the specificity of crucial in-school resources affecting the learning process. Implicit in similar research projects, however, is the assumption that formal

education is only one of the three basic influences upon a person's educational progress, the other two being native intelligence and motivation toward learning.

Policy and Non-Policy Independent Variables

In consideration of the above assumptions it is useful to distinguish two classes of independent variables. First there is the class of factors which form the "givens" of a particular situation, being either immanent or in some degree fortuitous. Demographic and socio-economic factors are descriptive of the constitution of a community providing the factors impinging upon educational achievement which lie outside the sphere of choice. Non-policy variables belong in this category. Alternatively, there is a class of factors which is the outcome of political decisions relating to education and which is therefore relatively accessible to manipulation. Policy variables belong in this category.

The distinction between these categories may be explained by an analogy with certain basic concepts from price theory in economics. Price theory focuses, in part, on the production costs of a firm. The economist has developed several analytic concepts as theoretical tools to assist in the identification of crucial elements that act as explanatory determinants of production costs. Two major categories of production costs are specified--fixed costs and variable costs. Fixed costs are those which in the aggregate are absolutely invariant to changes in output,

and are the costs of fixed factors such as depreciation and interest charges. Variable costs are those which in the aggregate vary with output, and are the costs of variable factors such as wages and materials. These two factors are expressive rather than unequivocal, and are not necessarily fully consistent. In effect, there are some fixed costs which may be variables and some variable costs which may be fixed (Bain, 1961:91).

To promote clarification of the dichotomy, price theorists make a further analytic distinction between short period and long period in the relation of cost to output. Bain (1961:90) describes it as:

In formal logic . . . the short period to which we shall refer is no especial? chronological time interval uniformly applicable to all sorts of firms, but a sort of 'operational period' arbitrarily defined as such length that buildings and long-lived equipment are invariant in quantity and that labor and materials are freely available in quantity.

Hence, the longer the time period envisaged, the fewer are the factors which may be considered as fixed. Thus the dichotomy between fixed and variable cost factors is essentially a short period concept.

Policy and non-policy factors that act as determinants of educational achievement, may be likened to the concepts of fixed and variable costs in the sense that clarification of the dichotomy revolves upon the short period concept. For instance, the existence of a public and separate school systems in Alberta might be expected to act as a

determinant of the level of academic achievement (Cheal, 1963:114-115). The existence of the two systems is derivative from a political decision, but once established, this factor cannot realistically be considered as capable of manipulation in the sense that the function of choice still prevails. This constitutional "given" has assumed the substance of immanence, set in tradition, and has become an intrinsic part of the environment.

Logically this factor may now be considered to be a non-policy variable. It is fruitful to think of the non-policy and policy categories within a form of "operational time period" kindered to the short period concept, which may be arbitrarily defined as such length of time that constitutional constraints are impervious to political manipulation, while factors such as pupil-teacher ratios and the tax rate are accessible to variations by policy makers.

This distinction in terms of an arbitrarily defined time period is crucial to the relationship between the two major categories. It may be easily shown that socio-economic factors are capable of manipulation by political action. Pierce (1947), for instance has reasoned that community change may be guided and controlled by educators working in concert with planning boards and zoning authorities. There is abundant literature on methods available to educators for developing supportive attitudes to education and for activating the public to an awareness of the need for better schools.

It is a thesis of this study that actions such as those noted by Pierce (1947) are longer range activities, both in their stimulus and effects, than the more immediate political actions impinging directly upon education expenditures, such as the determination of salary levels and provincial aid to education. The distinction between non-policy and policy determinants is not, therefore, rigid but it is analytically pertinent in that it allows for the grouping of factors according to their apparent susceptibility to political manipulation.

V. PLACEMENT OF VARIABLES

From logic and previous research projects on the relationship between educational achievement and inputs factors, a list of identified and presumed explanatory factors was derived. Each of the factors, or variables, may be fitted into the input-output relationship of this study (see Figure 1). The diversity and complexity of these possible influencing variables is apparent, and the listed variables cannot be expected to exhaust all possibilities.

It is not easy to assess the relative importance of separate factors as determinants of educational achievement from a survey of the completed empirical studies. This problem stems from the fact that the studies work with different dependent variables, diverse measures of selected factors, and apply to a variety of organizational units. A brief explanation of the placement of variables in this

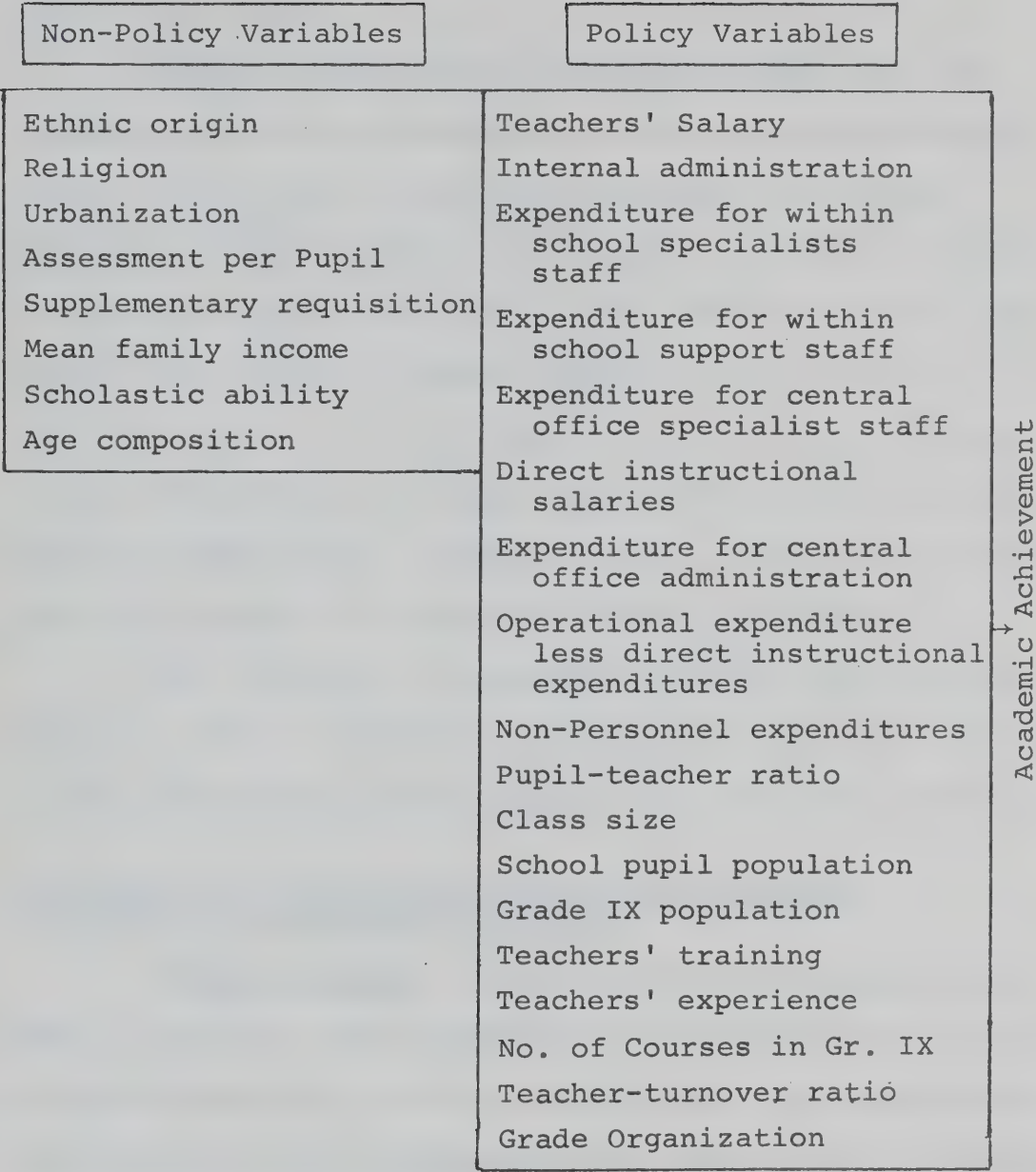


Figure 1: Expanded input-output relationship of variables relating to academic achievement.

study is in order.

Among the non-policy variables, there would be no quarrel with the placement of selected variables which measure native ability and socio-economic conditions. Population characteristics and factors relating to community wealth are clearly intrinsic to the school situation and beyond the ability of policy makers to vary--certainly in the short period. The placement of the amount of supplementary requisition per pupil within the policy variables might be questioned. However, in this study this factor is taken as a measure of community wealth in Alberta.

The placement of factors within the second major category, policy variables, follows from an earlier discussion of the distinction between policy and non-policy variables.

Description of Twenty-six Independent Variables Non-Policy Independent Variables

(Ethnic origin). This variable designated X_2 is used to indicate what percentage of the population living in a school community is of British origin. All enumeration areas in each school community were identified. A computer program using the 1961 census ethnic origin data was written and run to determine the ethnic origin of the population in the school community. It is reasonable to assume that the number of people of each ethnic origin in each school community would change since 1961, but the percentage of each ethnic group in each community should have remained approximately the same.

The source of data for this variable is the Decennial Census of Canada, 1961, and the data for the three groups of schools are provided in Table II, page 45-46.

(Religion). The third independent variable is percentage of the pupils Roman Catholic and is designated X_3 . In separate schools it was assumed that 100 percent of the pupils were Roman Catholic. A survey of four schools showed that less than one percent of the pupils was not Roman Catholic. The source of the data for all other schools was the Decennial Census of Canada, 1961. A computer program was written and run to determine the percent of Roman Catholics in the enumeration areas of the school community. The percent ages obtained were used as an approximation of the percentage of Roman Catholic pupils in the school. The data are provided in Table II, page 45-46.

(Urbanization). The third independent variable is used to indicate whether the school is located in an urban place and is designated X_4 . The definition of urbanization used in this study is much more limited than the definitions of urbanizations in most previous studies. It is intended to tap a specific characteristic of urbanization, that of a particularly large aggregate of people. The source for this variable is the Decennial Census of Canada, 1971, and the data are provided in Table II, page 45-46

(Assessment per pupil). The equalized assessment

TABLE II

MEAN SCORE AND STANDARD DEVIATION OF DEPENDENT AND INDEPENDENT VARIABLES
IN GROUPS OF ALBERTA SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

	Variable	High Achieving		Med. Achieving		Low Achieving	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
X ₁	Achievement	60.31	1.80	56.28	1.03	51.36	2.52
X ₂	Percent British	52.69	13.21	56.07	7.82	39.69	18.09
X ₃	Percent Roman Catholic	28.73	37.33	50.80	47.99	71.29	37.26
X ₄	Urbanization	1.26	46	1.67	.49	1.64	.50
X ₅	Assessment per Pupil	\$ 26.40	14.91	18.66	11.48	23.14	12.01
X ₆	Supplementary Requisition	\$ 98.07	24.16	91.06	20.11	76.07	26.68
X ₇	Mean Family Income	\$7737.20	2522.68	8644.73	1960.00	7776.57	1791.19
X ₈	Scholastic Ability	286.93	1.81	285.73	1.43	281.71	3.17
X ₉	Age in Months	178.40	2.47	180.00	1.89	182.93	5.00
X ₁₀	Teachers' Salary	\$9577.13	908.90	9079.53	1351.11	9580.42	1094.72
X ₁₁	Internal Administration	\$ 38.52	14.91	18.66	11.48	23.14	12.01
X ₁₂	In School Special Serv.	\$ 18.66	11.49	24.05	11.19	22.21	11.76
X ₁₃	In School Support Staff	\$ 12.03	4.82	17.19	5.10	19.22	4.73
X ₁₄	Central Off. Special Staff	\$ 5.19	2.56	7.85	3.43	8.17	2.35

TABLE II (continued)

Variable	High Achieving		Med. Achieving		Low Achieving	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
X ₁₅ Direct Instruc. Exp. Cost	\$ 22.41	4.76	20.24	6.77	19.92	5.83
X ₁₆ Central Off. Admin.	\$ 20.83	5.40	23.10	4.51	26.05	1.56
X ₁₇ Op. Expend. less direct Instruc. Expend.	\$ 657.71	63.94	649.13	82.19	655.08	38.42
X ₁₈ Non-personal Expend.	\$ 346.78	66.85	379.66	26.85	341.56	53.26
X ₁₉ Pupil Teacher Ratio	21.33	4.10	19.87	3.38	21.64	3.54
X ₂₀ Gr. IX lass ize op.	28.06	5.26	26.60	4.87	26.00	5.97
X ₂₁ School Population	564.67	191.93	554.80	169.92	456.50	203.50
X ₂₂ Grade IX opulation	66.67	43.56	101.67	66.46	75.07	48.37
X ₂₃ Teacher Training	4.00	.38	3.82	.74	4.04	.59
X ₂₄ Teachers' Experience	9.94	3.56	7.01	4.38	5.81	3.26
X ₂₅ No. of Gr. IX Courses	16.40	7.89	16.46	4.78	16.50	5.49
X ₂₆ Teacher Turnover Ratio	14.81	2.96	10.9	1.88	13.30	3.78
X ₂₇ Grade Organization	2.27	1.28	2.33	.98	2.50	.86

For details of Variables refer to Table III.

per pupil is the fourth independent non-policy variable designated X_5 . This is used as a measure of economic ability of the school district. The school communities are in rank order for 1 to 44 with 1 being highest assessment per capita, and 44 being the lowest assessment per capita. The source of data is the Annual Report of the Alberta Department of Education, 1971, and the data are provided in Table II, pp. 45-46.

(Supplementary requisition). The fifth independent non-policy variable is the supplementary requisition per pupil. This was calculated by calculating the amount of the total school district's educational expenditure which was derived from the supplementary requisition. This variable is designated X_6 , and it is held to be representative of the economic ability or fiscal capacity of the local community to support public education. The Alberta Department of Education Annual Report for 1971 (to be published) is the source of data and the data are shown in Table II, pp. 45-46.

(Mean family income). The mean family income of families in the school communities is the sixth independent non-policy variable X_7 . This is held as a measure of economic ability. A computer program was written and run to determine the mean family income of the people living in each of the 44 school communities using the 1961 Decennial Census of Canada data. The mean family incomes are in current dollars. Current dollars were then calculated by multiplying the 1961 mean family income figures by 1.86. The increase in

average weekly earnings in Alberta from 1961 to 1971 was 86 percent (D.B.S., 1971). The data for X_7 are provided in Table II, pp. 45-46.

(Scholastic ability). The independent non-policy variable is the mean scholastic ability of grade nine pupils as measured on the SCAT Verbal and Quantitative Tests, X_8 . The data for this variable are the Scholastic Ability scores for the 3576 grade nine students who wrote the Alberta Government tests in the spring of 1971. These were made available by the Operations Research Branch of the Alberta Department of Education. Scholastic Ability mean scores were calculated for each school. The data for this variable are shown in Table II, pp. 45-46.

(Age of grade IX pupils). The mean age of grade IX pupils is the eight independent non-policy variable and is designated X_9 . The date of birth of the 3576 grade IX students was provided by the Operations Research Branch of the Alberta Department of Education. The ages in month of each pupil was calculated to enable the mean age of grade IX pupils attending each of the schools in the sample to be calculated. The data for this are shown in Table II, pp. 45-46.

Independent Policy Variables

The input-output relationship in this study suggests a number of policy variables. The policy variables in this study are:

(Mean salary of grade IX teachers). The first independent policy variable is the mean salary of grade IX teachers and is designated X_{10} . The source of data is the Pilot Project on PPBES, Alberta Department of Education, 1971. The data are for the school year 1970-71, and the data are shown in Table II, pp. 45-46.

(Internal administration expenditure). The actual expenditure per pupil, for administration within each school is independent policy variable number two and it is designated X_{11} . The source of data is the PPBES Pilot Project, Alberta Department of Education. The data are for the 1970-71 school year and the data are provided in Table II, pp. 45-46.

(Expenditure for within school special staff). The third independent policy variable is expenditure per pupil for special staff within the school, and is designated X_{12} . The source of data for this variable is the PPBES Pilot Project, Alberta Department of Education. The data are for the school year 1970-71, and these data are shown in Table II, pp. 45-46.

(Expenditure for within school support staff). Expenditure per pupil for support staff within each school is independent policy variable number four and it is designated X_{13} . The source of the data is the PPBES Pilot Project, Alberta Department of Education. The data are provided in Table II, pp. 45-46, and they are for the school year 1970-71.

(Expenditure for central office specialist staff).

The fifth independent policy variable is the expenditure per pupil for central office specialist staff and is designated X_{14} . The source of data are the 1971 Annual Report, Department of Education. The data are shown in Table II, pp. 45-46.

(Expenditure for direct instruction). Direct instructional salaries is independent policy variable six, and it is designated X_{15} . The source of the data is the PPBES Pilot Project, Alberta Department of Education. The data are provided in Table II, pp. 45-46.

(Expenditure for central office administration). The seventh independent policy variable is expenditure per pupil for central office administration, X_{16} . The source of these data is the Alberta Department of Education Annual Report for 1971.(to be published). The data are shown in Table II, pp. 45-46.

(Operational expenditure less direct instructional salaries). The eighth independent policy variable is operational expenditure per pupil less direct instructional salaries. This variable is designated X_{17} . The data are calculated from information from the Alberta Government PPBES Pilot Project 1971. The data are for the school year 1970-71 and are shown in Table II, pp. 45-46.

(Non-personnel expenditure). All expenditures

other than these for personnel were measured in the ninth independent variable, X_{18} . The source of data is the Alberta Department of Education PPBES Pilot Project, 1971. The data are provided in Table II, pp. 45-46.

(Grade IX pupil teacher ratio). The tenth independent policy variable is grade IX pupil-teacher ratio and it is designated X_{19} . This measure was calculated from information in the Alberta Department of Education PPBES Pilot Project, 1971. The data are shown in Table II, pp. 45-46.

(Average grade IX class size). This eleventh independent policy variable is designated X_{20} . Average class size helps to elaborate information contained in the teacher pupil ratio measure, (X_{19}). For example, it is possible for a school to have a relatively high ratio of pupils to teachers, but if each teacher instructs in a large number of classes, average class size may be relatively low. The data for this variable are calculated from the information in the Alberta Department of Education PPBES Pilot Project. The data are provided in (Table II, pp. 45-46).

(Teacher turnover ratio). The seventeenth independent policy variable X_{26} , is the number of teachers who resigned in each school in June, 1971 divided by the total number of teachers in that school. The source of data for this variable was a questionnaire to Principals (Appendix B). The data were completed by telephone calls to seven schools

and information from the Operations Research Branch Alberta Department of Education. Table II, pp. 45-46, provides the data.

(Grade organization in the schools). This variable X_{27} , indicates what grades are taught in each school. Schools which teach grade 1-12 are designated 1, 1-9 are designated 2, 7-12 are designated 3, and 7-9 are designated 4. The source of the data was the Operations Research Branch, Alberta Department of Education. The data are provided in Table II, pp. 45-46.

The Approach and the Techniques

The input-output relationship used in this study has been drawn from a general analogy with production functions as they have been developed for the analysis of inputs and outputs of firms and industries. However, as Burkehead pointed out the difficulties that have been encountered in the application of this approach to educational institutions would suggest that the phrase "input-output relationships" would be a more appropriate description than the more rigorous concept of production function (1967:38).

For each of the 27 variables selected for the study data were collected in Alberta for 44 schools for the school year 1970-71. Most of the statistical data for the 27 variables were collected directly or derived from various federal, provincial and municipal published or unpublished studies. The only data not readily available were information

an ethnicity and teacher-turnover ratio. As a consequence a questionnaire was sent to the principals of the 44 schools. The teacher turnover ratio data from this questionnaire were used in this study, but the information on ethnic origin was so scantily provided that the 1961 data from the Canadian Decennial Census were used as a replacement. The data for each of the twenty-seven variables are provided in Table II, pp. 45-46.

The data for the independent variables were classified as non-policy and policy variables. The values for all variables were punched on IBM cards and computer programs were designed to enable various statistical techniques to be effected by the computer.

The empirical analysis was undertaken in three phases but first the 44 schools were divided into three groups with 15 high academic achieving schools, 15 medium academic achieving schools and 14 low academic achieving schools (Table I, pp. 28-31). The mean test score for the 15 schools which were categorized as high achieving schools was 60.31 with a standard deviation of 1.81, for the 15 medium achieving group of schools the mean test score was 56.28 with a standard deviation of 1.03 and in the 14 schools categorized as low achieving the mean test score was 51.30 with a standard deviation of 2.52.

Simple correlation for X_1 (academic achievement)
and independent variables. The first phase of the empirical

analyses involved the computation of simple correlation coefficients between the dependent variables X_1 (academic achievement) and each of the values of the independent variables in each of the non-policy and policy classifications.

Analyses of Variance for X_1 and non-policy independent variables. In the second phase of the study involved a one-way analysis of variance which was used to assess the relative magnitude of variation in academic achievement resulting from the following non-policy variables: (1) ethnicity of pupils (2) per cent of pupils Roman Catholic (3) urbanization (4) equalized assessment per capita (5) supplementary requisition as a per cent of total school district expenditure (6) a mean family income (7) scholastic ability of grade nine pupils (8) age of grade nine pupils.

The relative magnitude of variation resulting from the different sources was assessed for acceptance or rejection under the null hypothesis. The point of probability for rejecting the no difference or null hypothesis in this study was the 0.05 level. The Sheffé test was used to test the significance of results. The 0.10 level of significance was used as recommended by Sheffé (Ferguson, 1961:297).

Assumptions of Analysis of Variance

Three important assumptions made in analysis of variance are, (a) normality of errors in the population and in models, (b) equality of variance in the errors, and (c) statistical independence of the errors (Sheffé, 1959:311). The effects of departures from these assumptions have been investigated but complete knowledge of these effects has not

been obtained as Scheffé states, because assumptions may be violated in more ways than they can be satisfied. Scheffé is cautious in advocating departures from the assumptions of analysis of variance but records difficulties stemming from lack of independence "as the most formidable to cope with" (Scheffé, 1959:364). Authors such as Winer and Edwards accept the conditions of the Box studies which indicate that the F-test is "robust" under violations of the assumptions of normality and equality of variance. Such effects as these tend to increase the probability of type I errors. Effects upon type II errors are less clear (Scheffé, 1959:357). Thus Winer concludes in regard to the F-test that:

The magnitude of type I error is not seriously affected if the distributions depart moderately from normality or if the population variance departs moderately from equality; i.e., the test is robust with respect to the assumption of normality of distribution and homogeneity of error variance (Winer, 1962:61).

Analysis of Covariance for X_1 and Policy Variables with Significant non-Policy Variables as Covariables

The third phase of the study includes a series of Analyses of covariance to assess the variation in academic achievement which is assignable to each of the 18 policy variables while attempting to "control" or adjust for the effects of the non-policy variables which were found to be significant in phase two of the empirical analysis.

Because the third phase of this study does not come within the assumptions of analysis of variance with regard to lack of independence in observations, an analysis

of covariance is used for the third phase of the study.

The analysis of covariance is an extension of the analysis of variance technique to take into account possible effects on the dependent variable of uncontrolled variables or covariates. If direct control or "experimental control," was utilized in the study all relevant or concomitant variables would have been controlled for experimental error in the design of the study. In designing this study such control was not possible, thus, analysis of covariance was used for controlling experimental error due to selected variables which were not controlled for in the experimental design.

This statistical control is facilitated by making appropriate adjustments to the criterion means for the various treatment conditions. In order to statistically control the concomitant variables (non-policy variables) one is required to compute: (1) the correlation between the concomitant variables and the criterion variables, and (2) the coefficient of regressions of the criteria on the concomitant variables. Given this information, the researcher can adjust the criterion measures for the effects of the concomitant variables (Winer, 1962). After the criterion scores are adjusted, the traditional analyses of variance techniques were applied to the adjusted criterion scores.

To statistically control the concomitant variables (non-policy variables) the researcher took into consideration the following assumptions (Lindquist, 1956).

1. The subjects in each treatment were originally either (a) selected at random from the same population; or (b) selected from the same parent population on the basis of their concomitant measure only.
2. The concomitant measures are unaffected by the treatments.
3. The criterion measures for each treatment group are random sample for those of a corresponding treatment population.
4. The regression of the criterion measure on the concomitant measure is the same for all treatment populations
5. The regression in assumption number four is linear.
6. The distribution of adjusted scores for each treatment population is normal.
7. The distribution of adjusted scores have the same variance.

There was concern that the concomitant variables (non-policy) would influence the results regarding the policy variables. In this study the concern was whether a large proportion of variance in the criterion variable could be predicted with only a knowledge of the non-policy variables. The concern was expressed in the question: Does the additional knowledge of the policy variables improve the prediction of the criterion variable (academic achievement) over and above that which the concomitant variables (non-policy) predict?

If the analyses of covariance shows that the treatments do not have a different effect on the criterion measures in addition to the effect of the non-policy variables we can answer the question posed in the previous paragraph in the following way. The additional knowledge of the treatment groups and policy variables does not significantly improve the ability to predict academic achievement scores of students in groups of schools, given the data on the non-policy variables relating to the schools.

SUMMARY

The input-output relationships of achievement and the policy and non-policy independent variables provided the logical basis for the selection of variables for the empirical phase of this study. One dependent variable and 26 independent variables were identified. The 26 independent variables are composed of 8 non-policy variables and 18 policy variables.

A large portion of the data had its source in the reports of the Alberta Government Department of Education Program Budgeting Pilot Project, 1970-71. Data for achievement scholastic ability, and age were computed from the records of students for the 1971 Alberta Department of Education grade nine tests.

Data from Census Canada for enumeration areas corresponding to school attendance areas were used for ethnic origin, mean family incomes, and religion in the non-separate schools districts.

The empirical analyses was divided into three phases. The first part involved the computation of simple correlation coefficients between the dependent variable X_1 (academic achievement) and each of the values of the independent variables in each of the non-policy and policy classifications. The second part of the empirical analysis involved an analysis of variance technique using academic achievement as the criterion. The third phase of the empirical analysis consisted of the use of academic achievement as the criterion, significant non-policy variables as covariates, and the examination of policy variables through an analysis of covariance technique. The study was considered as a heuristic exercise in the area of the output of education.

The findings of the empirical analysis are reported in chapter IV.

CHAPTER IV

THE FINDINGS

The findings of the empirical phase of this study which involves the investigation of the relationships between academic achievement of grade nine students, X_1 , and eight non-policy and eighteen policy variables are given in this chapter. The presentation of the findings is organized on the basis of the statistical study detailed in the previous chapter. The relevance and nature of the study have been indicated in Chapter I. The selected variables and the techniques employed in the empirical stages of the study have been advanced in Chapter III. In Table III, there is provided a list of the variables used in this study, each with its identifying number.

Simple Correlations for X_1 (Academic Achievement) and Independent Variables

While analyses of variance and analyses of covariance procedures are the main forms of analyses in this study the simple correlation coefficient between independent variables and the dependent variable merit an initial commentary.

Non-Policy, Independent Variables

The simple correlations between the non-policy independent variables and the dependent variable X_1 (academic achievement) are given in Table IV. It is noteworthy that

TABLE III
SUMMARY OF VARIABLES

Dependent Variable

- X₁ Mean academic achievement score on the Alberta
Department of Education grade nine tests, 1971.
-

Independent Variables

Variables Reflecting Non-Policy Factors

- X₂ Ethnicity of grade nine pupils--per cent of grade
nine pupils of British origin.
- X₃ Per cent of pupils who are Roman Catholic.
- X₄ The location of the school. Urban area or non-
urban area.
- X₅ Equalized assessment per capita in the school
jurisdiction.
- X₆ Amount of supplementary requisition as a per cent
of total educational expenditure.
- X₇ Mean family income in the school jurisdiction.
- X₈ Scholastic ability of grade nine pupils.
- X₉ Mean age of grade nine pupils.

Variables Reflecting Policy or Political Factors

- X₁₀ Salary of grade nine teachers.
- X₁₁ Expenditure per grade nine pupil for internal
administration.
- X₁₂ Expenditure per grade nine pupil for specialist
staff within the school.
- X₁₃ Expenditure per grade nine pupil for support staff
within the school.
- X₁₄ Expenditure per grade nine pupil for central office
specialist staff.
- X₁₅ Expenditure per grade nine pupil for direct
instructional salaries.
- X₁₆ Expenditure per grade nine pupil for central office
administration.
- X₁₇ Total operational expenditure per pupil less direct
instructional salaries.

TABLE III (continued)

X ₁₈	Total educational expenditure per pupil less total expenditure per pupil for personnel.
X ₁₉	Pupil-teacher ratio in grade nine.
X ₂₀	Average class size in grade nine.
X ₂₁	School pupil population.
X ₂₂	Grade nine pupil population.
X ₂₃	Numbers of years of training of grade nine teachers.
X ₂₄	Number of years experience of grade nine teachers.
X ₂₅	Number of courses taught in grade nine.
X ₂₆	Teacher-turnover ratio.
X ₂₇	Grade organization in the school.

TABLE IV

SIMPLE CORRELATION OF NON-POLICY INDEPENDENT
VARIABLES AND THE DEPENDENT VARIABLE, X₁^a

Independent Variables ^a	Simple Correlations
X ₂	.361 ^b
X ₃	-.434 ^b
X ₄	-.239
X ₅	-.002
X ₆	.396 ^b
X ₇	.062
X ₈	.824 ^b
X ₉	-.583 ^b

^aFor details of variables refer to Table III

^bSignificant at the 0.05 level

Sources:

X₂, X₃, X₇, Calculated from Decennial Census of Canada 1961.

X₄, Decennial Census of Canada, 1971.

X₅, X₆, Calculated from information received from, Division of Instruction, Alberta Department of Education.

X₈, X₉, Calculated from information provided by the Operations Research Branch, Alberta Department of Education.

five of the independent non-policy variables have simple correlation coefficients with the dependent variable which reach the 0.05 level of significance: X_2 , per cent of grade nine pupils of British ethnic origin, X_3 , per cent of students who are Roman Catholic, X_6 , supplementary requisition as a per cent of the total school district educational expenditure, X_8 , scholastic ability of grade nine students and X_9 , mean age of grade nine pupils. The lack of significance of mean family income, urbanization and assessment per capita is conspicuous.

The direction of X_4 urbanization, although not being significant is noteworthy. This may be partly explained by the nature of the foundation program for financing education in Alberta and the present demands on urban areas because of social and economic problems.

The simple correlation coefficients for each of the remaining non-policy variables exhibit the anticipated results. A very substantial influence was made by X_8 , scholastic ability of the grade nine pupils. The per cent of variance accounted by this variable of the dependent variable X_1 (academic achievement) amounts to 68 per cent. It is apparent that five of the non-policy variables are significantly associated with variability in academic achievement.

Policy Independent Variables

The simple correlation coefficients between policy independent variables and the dependent variable, X_1 ,

(academic achievement) are given in Table V.

It is noteworthy that only five of the independent policy variables have simple correlation coefficients with the dependent variable which reach the .05 level of significance: X_{13} expenditure per grade nine pupil for support staff within the school, X_{14} , expenditure per grade nine pupil for central office specialist staff, X_{16} , expenditure for central office administration per grade nine pupil. X_{21} , school pupil population and X_{24} number of years experience of grade nine teachers. Of the five significant independent policy variables only X_{21} , central office expenditure per grade nine pupil and X_{24} , the number of years of experience of grade nine teachers showed a positive significant correlation coefficient. The negative influence of X_{13} , expenditure for support staff within the school, X_{14} , expenditure for central office specialist staff and X_{16} , expenditure for central office administration per grade nine pupil, is particularly noteworthy.

RELATIONSHIPS BETWEEN ACADEMIC ACHIEVEMENT AND INDEPENDENT VARIABLES

Analysis of Variance for X_1 (Academic Achievement) and Non-Policy Independent Variables

The second phase of the empirical analyses employed an analysis of variance procedure to determine relationships between the dependent variable X_1 (academic achievement) and the non-policy independent variables.

TABLE V
SIMPLE CORRELATIONS OF POLICY INDEPENDENT VARIABLES
AND THE DEPENDENT VARIABLE, X_1 ^a

<u>Independent Variables</u>	<u>Simple Correlations</u>
X_{10}	.006
X_{11}	- .069
X_{12}	- .206
X_{13}	- .503 ^b
X_{14}	- .361 ^b
X_{15}	+ .131
X_{16}	- .384 ^b
X_{17}	.071
X_{18}	.079
X_{19}	.034
X_{20}	.236
X_{21}	.303 ^b
X_{22}	.026
X_{23}	- .064
X_{24}	.447 ^b
X_{25}	.067
X_{26}	.034
X_{27}	- .083

^aFor details of variables refer to Table III, pp. 61-62.

^bSignificant at the 0.05 level or better.

Sources:

X_{10} , X_{11} , X_{12} , X_{15} , X_{21} , X_{22} , X_{23} , X_{24} , X_{25} , Calculated from information in Alberta Department of Education PPBES Pilot Project 1971.

X_{13} , X_{14} , X_{16} , Calculated from Alberta Department of Education Annual Report, 1971.

X_{26} Calculated from Principals' Questionnaire

X_{17} , X_{18} , X_{19} , X_{20} , X_{27} , Calculated from Alberta Department of Education Annual Report 1971, and PPBES Pilot Project 1971.

Variable X_2 (Ethnic Origin)

The relationship between variable X_1 (academic achievement) and X_2 ethnicity is found in Table VI. The probability level of 0.006 for the obtained F ratio for the above distribution showed that at least one significant difference occurred between pairs of means of the three groups. Thus, there is a significant difference between the mean per cent of students of British origin in groups of schools of different achievement levels.

The difference between the mean percentage of pupils of British origin for schools categorized in groups of high medium and low achievement was shown by the Sheffé test to be significant at the .046 and .009 levels respectively (Table VII). Inspection of means in Table VI and VII showed that among the schools used in the study, the schools categorized as having a low academic achievement had a lowest mean per cent of pupils of British origin. The schools categorized as medium academic achieving schools had a slightly higher per cent of students of British origin than the schools categorized as high achieving.

Variable X_3 (Per cent of Pupils Roman Catholic)

The mean per cent of Roman Catholic pupils in the highest achieving group was 28.73, in the medium achieving group 50.80 and in the lowest achieving groups 71.29.

TABLE VI

COMPARISON OF THE MEAN PER CENT OF GRADE NINE STUDENTS
OF BRITISH ORIGIN IN GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean % Br. Origin Pupils	Variance
1. High	15	52.69	174.46
2. Medium	15	56.07	61.12
3. Low	14	39.69	327.35
F 5.82	P .006		

TABLE VII

PROBABILITY MATRIX FOR SCHEFFÉ MULTIPLE COMPARISON OF
MEAN PER CENT OF GRADE NINE STUDENTS OF BRITISH
ORIGIN IN GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Group	Mean % of Br. Origin		Probability
1 and 2	52.69	56.07	.793
1 and 3	52.69	39.69	.046
2 and 3	56.07	39.69	.009

Source: Ethnic origin data were calculated from Census of
Canada, 1961.

The probability level of .029 for the obtained F ratio of 3.86 for the above distribution showed that at least one significant difference occurred between pairs of means of the three groups (Table VIII). There is a significant difference in per cent of grade nine students who are Roman Catholic in groups of schools of different achievement levels. The Scheffé test showed that between groups one and group three there was a significant difference at the .029 level (Table IX).

An examination of the means in Table IX showed that lower achieving groups of schools had the highest per cent Roman Catholic population and the highest achieving groups of schools had the lowest per cent of Roman Catholic students.

Variable X₄ (Urbanization)

The probability level of .050 for the obtained F ratio for the distribution in Table X showed that at least one significant difference occurred between pairs of means of the three groups in urbanization (Table XI).

The difference between the means for urbanization for groups 1 and 2 was shown by the Scheffé test in Table XI to be significant at the 0.09 level. Inspection of the means in Table XI showed the relationship of means to be slightly curvilinear as the highest achieving group of schools had a slightly lower percentage of schools in urban areas than did the medium achieving group of schools.

TABLE VIII

COMPARISON OF MEAN PER CENT OF GRADE NINE STUDENTS WHO
ARE ROMAN CATHOLIC IN GROUPS OF SCHOOLS OF
DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean % Roman Catholic Students	Variance
1. High	15	22.73	1393.50
2. Medium	15	50.80	2302.89
3. Low	14	71.29	1388.23
F 3.86	P .029		

TABLE IX

PROBABILITY MATRIX FOR SCHEFFÉ MULTIPLE COMPARISON OF
MEAN PER CENT OF STUDENTS WHO ARE ROMAN CATHOLIC
IN GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Groups	Mean % Roman Catholic Students		Probability
1 and 2	28.73	50.80	.352
1 and 3	28.73	71.29	.029
2 and 3	50.80	71.29	.417

Source: Religion data were calculated from Census of Canada 1961.

TABLE X

COMPARISON OF MEAN URBANIZATION OF GRADE NINE STUDENTS
IN GROUPS OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean % Urbanization of Students	Variance
1. High	15	1.27	.21
2. Medium	15	1.67	.24
3. Low	14	1.64	.25
F 3.24	P .050		

TABLE XI

PROBABILITY MATRIX FOR SHEFFÉ MULTIPLE COMPARISON OF
MEAN URBANIZATION OF GRADE NINE STUDENTS IN GROUPS
OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Groups	Mean Urbanization		Probability
1 and 2	1.27	1.67	.09
1 and 3	1.27	1.64	.12
2 and 3	1.67	1.64	.99

Source: Urbanization data--Census of Canada, 1971.

Variable X₅ (Equalized Assessment per Capita).

The probability level of .269 for the obtained F ratios for the distribution in Table XII indicated that there were no significant differences between pairs of means for the three groups of schools in equalized assessment per capita (Table XIII).

Variable X₆ (Supplementary Requisition as a Per Cent of Total District Education Expenditure)

The probability level of 0.05 for the obtained F ratio for the distribution in Table XIV showed that at least one significant difference occurred between pairs of means of the three groups of schools. There is a significant difference in the supplementary requisition as a per cent of total district expenditure in groups of schools of different achievement levels.

The Scheffé test in Table XV showed that the difference between group 1 and group 3 was significant at the .050 level.

Inspection of the means in Table XVI showed that as the groups of schools increased supplementary requisition as a percentage of total district educational expenditure, the achievement levels increased. The highest achieving group of schools had the highest percentage of total district educational expenditure coming from supplementary requisition.

Variable X₇ (Mean Family Income)

The probability level of 0.427 for the obtained F ratio for the distribution in Table XVI showed that there were

TABLE XII

COMPARISON OF MEAN EQUALIZED ASSESSMENT PER CAPITA OF
GRADE NINE STUDENTS IN GROUPS OF COMMUNITIES WITH
SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Levels	No. of Schools in Grp.	Mean Equalized Assessment per Capita in \$	Variance
1. High	15	26.40	222.40
2. Medium	15	18.66	131.66
3. Low	14	23.14	144.13
F 1.36	P .269		

TABLE XIII

PROBABILITY MATRIX FOR SCHEFFÉ MULTIPLE COMPARISON OF MEAN
EQUALIZED ASSESSMENT PER CAPITA IN GROUPS OF SCHOOL
COMMUNITIES WITH SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Groups	Equalized Assessment Means in \$		Probability
1 and 2	26.40	18.66	.271
1 and 3	26.40	23.14	.795
2 and 3	18.66	23.14	.649

Source: Equalized Assessment data were calculated from
information provided by the Division of instruction,
Alberta Department of Education.

TABLE XIV

COMPARISON OF MEAN SUPPLEMENTARY REQUISITION PER CAPITA OF
GRADE NINE STUDENTS IN GROUPS OF COMMUNITIES WITH
SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Supplementary Requisition in \$	Variance
1. High	15	98.07	584.07
2. Medium	15	91.07	404.21
3. Low	14	76.07	711.92
F 3.23	P .050		

TABLE XV

PROBABILITY MATRIX FOR SCHEFFÉ MULTIPLE COMPARISON OF
MEAN SUPPLEMENTARY REQUISITION PER CAPITA IN GROUPS
OF COMMUNITIES WITH SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Groups	Mean Supplementary Requisition in \$		Probability
1 and 2	98.07	91.07	.724
1 and 3	98.07	76.07	.055
2 and 3	91.07	76.07	.247

Source: Supplementary requisition per capita data were calculated from information provided by the Division of Instruction Alberta Department of Education and Canada Census, 1971.

TABLE XVI

COMPARISON OF MEAN FAMILY INCOME IN COMMUNITIES WITH
GROUPS OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Family Income in \$	Variance
1. High	15	7737.19	6363904.00
2. Medium	15	8644.73	3841609.00
3. Low	14	8059.11	3208369.00
F 0.87	P 0.427		

TABLE XVII

PROBABILITY MATRIX FOR SCHEFFÉ MULTIPLE COMPARISON OF
MEAN FAMILY INCOME IN COMMUNITIES WITH GROUPS OF
SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Groups	Mean Family Income in \$		Probability
1 and 2	7737.19	8644.73	0.509
1 and 3	7737.19	8059.11	0.999
2 and 3	8644.73	8059.11	0.550

Source: Family Income data were calculated from Census of
Canada, 1961, and Statistics Canada, 1971.

no significant differences occurred between means of the high, medium, and low achieving schools. There was no significant difference in the mean family income in groups of schools of different achievement levels (Table XVII).

Scholastic Ability

The probability level of 0.000 for the obtained F ratio for the distribution in Table XVIII showed that at least one significant difference occurred between pairs of scholastic ability means of the three groups. There was therefore a significant difference in the mean scholastic ability scores in groups of schools in different achievement levels.

The Scheffé test in Table XIX showed that the difference between means 1 and 3 was significant at the .0001 level and the difference between means 2 and 3 was significant at the .0001 level.

Inspection of the means in Table XVII showed that high achieving schools had a higher mean scholastic ability than medium achieving schools and medium achieving schools had a higher mean scholastic ability than did low achieving schools.

Age of Grade Nine Pupils

The probability level of .003 for the obtained F ratio of age of grade nine pupils (Table XX). At least one significant difference occurred between pairs of means of the

TABLE XVIII

COMPARISON OF MEAN SCHOLASTIC ABILITY SCORES OF GRADE NINE
STUDENTS IN GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Scholastic Ability Score	Variance
1. High	15	286.93	3.29
2. Medium	15	285.73	2.07
3. Low	14	281.71	10.08
F 21.93	P .000		

TABLE XIX

PROBABILITY MATRIX FOR SCHEFFÉ MULTIPLE COMPARISON OF
MEAN SCHOLASTIC ABILITY SCORES OF GRADE NINE
STUDENTS IN GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Groups	Mean Scholastic Ability Scores		Probability
1 and 2	286.93	285.73	.340
1 and 3	286.93	281.71	.000
2 and 3	285.73	281.71	.000

Sources: Scholastic ability data were provided by the
Operations Research Branch, Alberta Department of
Education.

TABLE XX

COMPARISON OF MEAN AGE IN MONTHS OF GRADE NINE STUDENTS
IN GROUPS OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Age in Months	Variance
1. High	15	178.40	6.12
2. Medium	15	180.00	3.57
3. Low	14	182.93	25.00
F 6.76	P .003		

TABLE XXI

PROBABILITY MATRIX FOR SCHEFFÉ MULTIPLE COMPARISON OF
MEAN AGE IN MONTHS OF GRADE NINE STUDENTS IN
GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Groups	Mean Age in Months		Probability
1 and 2	178.40	180.00	.433
1 and 3	178.40	182.93	.003
2 and 3	180.00	182.93	.074

Source: Pupil age data were provided by the Operations
Research Branch, Alberta Department of Education.

three groups.

The Scheffé test showed that there were two significant differences between pairs of groups. The difference between means 1 and 3 was significant at the 0.003 level and the difference between means 2 and 3 was significant at the 0.074 level.

Examination of the means in Table XXI showed that the mean age of the pupils increased from the lowest achieving group of schools to the highest achieving group of schools.

Analysis of Covariance for X_1 Academic Achievement and all Policy Independent Variables.

The third phase of the empirical analysis explained the analysis of covariance procedure to determine relationships between the dependent variable, X_1 (Academic Achievement) and the six policy independent variables which were found to be significant in Phase II of the study as listed in Table XXII,

Relationship Between Academic Achievement and Policy Variables

Variable X_{10} (mean salary of grade nine teachers). The mean salary of grade nine teachers in the group of schools categorized as high achieving was \$9577.13. In the group of schools categorized as middle achieving the mean teacher's salary was \$9079.53, and in the lowest achieving group the mean teacher's salary was \$9580.43.

There was no significant difference in the mean

TABLE XXII
SIGNIFICANT POLICY INDEPENDENT VARIABLES

Independent Variable	F Ratio	Probability
X_2	5.82	0.006
X_3	3.86	0.029
X_4	3.24	0.050
X_6	3.23	0.050
X_8	21.93	0.000
X_9	6.76	0.003

For details of variables see Table III, pp. 61.

salary of grade nine teachers in groups of schools of different achievement levels. The probability level of 0.392 for the obtained F ratio for the mean distribution showed that no significant difference occurred in the mean salary of grade nine teachers and academic achievement in groups of schools of different levels of Academic Achievement (Table XXIII).

When the possible effects of the six covariates, or uncontrolled non-policy variables were taken into account the probability level of 0.229 for the adjusted F ratio for the distribution in Table XXIV showed that no significant difference occurred in the mean salary of grade nine teachers and academic achievement in groups of schools of different levels of academic achievement when adjustments were made

TABLE XXIII

COMPARISON OF MEAN SALARY OF GRADE NINE TEACHERS IN
GROUPS OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Salary in \$	Variance
1. High	15	9577.13	826093.69
2. Medium	15	9079.53	1825664.00
3. Low	14	9580.43	1198198.00
F 0.96	P .392		

TABLE XXIV

COMPARISON OF MEAN SALARY OF GRADE NINE TEACHERS
ADJUSTED FOR THE EFFECTS OF, NON-POLICY
VARIABLES IN GROUPS OF SCHOOLS OF
DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean Salary in \$	Variance
1. High	15	9333.70	826057.12
2. Medium	15	9015.38	1825609.00
3. Low	14	9910.00	1198139.00
Adj. F 1.54	P .229		

Source: Data for teachers salaries was calculated from
information contained in Alberta Department of
Education PPBES Pilot Project, 1971.

for the significant non-policy variable.

Variable X₁₁ (Expenditure for Internal Administration)

There was no significant difference in the mean expenditure per pupil for internal administration in groups of schools of different academic achievement level.

The probability level of .674 for the obtained F ratio for the distribution in Table XXV showed no significant differences occurred in the mean expenditure for internal administration and the academic achievement of groups of schools of different levels of achievement.

A probability level of .229 for the adjusted F ratio for the distribution in Table XXVI was found when the possible effects of the six covariates or uncontrolled variables were taken into account. Thus, no significant difference occurred in the mean expenditures for internal administration per grade nine pupil and academic achievement in groups of schools of different levels of academic achievement when adjustments were made for the six significant non-policy variables. The probability level went from .674 for unadjusted means to .229 for adjusted means but an acceptable level of significance was not reached for the adjusted means.

X₁₂ Expenditure for Within School Special Staff

The probability level of 0.433 for the obtained F ratio indicated that there were no significant differences in mean expenditure for special staff within the school in

TABLE XXV

COMPARISON OF THE MEAN EXPENDITURE FOR INTERNAL
ADMINISTRATION OF GRADE NINE STUDENTS IN
GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Group Achievement Levels	No. of Schools in Grp.	Mean Expenditure in \$	Variance
1. High	15	38.51	66.22
2. Medium	15	42.11	112.54
3. Low	14	41.32	230.73
F .40	P .674		

TABLE XXVI

COMPARISON OF MEAN EXPENDITURE PER PUPIL FOR INTERNAL
ADMINISTRATION ADJUSTED FOR THE EFFECTS OF NON-
POLICY VARIABLES IN GROUPS OF SCHOOLS OF
DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean Expenditure in \$	Variance
1. High	15	40.22	66.22
2. Medium	15	39.06	112.25
3. Low	14	42.76	123.07
Adj. F .274	P .762		

Source: Data for expenditure for internal administration were calculated from information contained in Alberta Department of Education PPBES Pilot Project, 1971.

groups of schools of different achievement levels (Tables XXVII).

When the mean of expenditure for specialist services within the schools were adjusted for the significant non-policy variables, the probability level for the adjusted F ratio increased to .54700 shown in Table XXVIII. Thus, there were no significant differences between pairs of means of the three groups.

X₁₃ Expenditure for Within School Support Staff

The probability level of 0.0009 for the obtained F ratio for the distribution in Table XXIX showed that at least one significant difference occurred between pairs of means of the three groups and therefore, there would appear to be a significant difference in mean expenditure for within school support staff in groups of schools of different achievement levels.

A probability level of 0.202 for the adjusted F ratio for the distribution in Table XXX was found when the possible effects of the six non-policy variables which were found to be significant in phase two of the study were taken into account. The additional knowledge of the mean achievement for within the school support staff does not significantly improve the ability to predict the academic achievement scores of students in the three groups of schools given the data on the six non-policy variables used in this part of the empirical analysis.

TABLE XXVII

COMPARISON OF MEAN EXPENDITURE PER PUPIL WITHIN THE SCHOOL
FOR SPECIALIST SERVICES IN GROUPS OF SCHOOLS OF
DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp	Mean Expenditure in \$	Variance
1. High	15	18.66	131.98
2. Medium	15	24.05	125.20
3. Low	14	22.62	138.36
F .85	P .433		

TABLE XXVIII

COMPARISON OF EXPENDITURE PER PUPIL WITHIN THE SCHOOL FOR
SPECIALIST SERVICES ADJUSTED FOR THE EFFECTS OF NON-
POLICY VARIABLES IN GROUPS OF SCHOOLS OF
DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean Expenditure in \$	Variance
1. High	15	18.82	131.98
2. Medium	15	21.04	125.20
3. Low	14	25.26	138.36
Adj. F .614	P .547		

Source: Data for specialist services expenditure were
calculated from information contained in Alberta
Department of Education PPBES Pilot Project, 1971.

TABLE XXIX

COMPARISON OF MEAN EXPENDITURE PER PUPIL FOR SUPPORT STAFF
WITHIN THE SCHOOL FOR GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Expenditure in \$	Variance
1. High	15	12.03	23.21
2. Medium	15	17.19	26.04
3. Low	14	19.22	22.33
F 8.44	P .0009		

TABLE XXX

COMPARISON OF MEAN EXPENDITURE PER PUPIL FOR SUPPORT STAFF
WITHIN THE SCHOOL ADJUSTED FOR THE EFFECTS OF NON-POLICY
VARIABLES IN GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean Expenditure in \$	Variance
1. High	15	13.81	23.20
2. Medium	15	17.23	26.03
3. Low	14	17.27	22.33
Adj. F 1.68	P .202		

Source: Data for expenditure for support staff were calculated from information in Alberta Department of Education Annual Report 1971 (to be published).

X₁₄ Mean Expenditure for Central Office Specialist Staff

The probability level of 0.120 for the obtained F ratio of 4.94 for the distribution in Table XXXI indicated that at least one significant difference occurred between the pairs of means of the three groups of schools. There was a significant difference in the mean expenditure for central office specialist staff in groups of schools of different achievement levels.

However, when the means of the expenditure for central office specialist staff were adjusted for the six non-policy variables used in this part of the study, the probability level obtained for the adjusted F ratio was 0.261 (Table XXXII). The knowledge of the mean expenditure for central office specialists staff does not significantly improve the ability to predict the academic achievement of students in groups of schools given the data on the six non-policy variables used in this part of the empirical analysis.

X₁₅ (Expenditure for Direct Instructional Salaries)

There is no significant difference in the mean expenditure for direct instructional salaries as indicated by the probability level of 0.458 for the obtained F ratio of .74 (Table XXXIII). There is no significant difference in the mean expenditure for direct instructional salaries in groups of schools of different achievement levels.

TABLE XXXI

COMPARISON OF MEAN EXPENDITURE PER PUPIL FOR CENTRAL OFFICE
SPECIALIST STAFF IN GROUPS OF SCHOOLS OF
DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Expenditure in \$	Variance
1. High	15	5.19	6.55
2. Medium	15	7.85	11.77
3. Low	14	8.17	5.53
F 4.94	P 0.012		

TABLE XXXII

COMPARISON OF MEAN EXPENDITURE PER PUPIL FOR CENTRAL OFFICE
SPECIALIST STAFF ADJUSTED FOR THE EFFECTS OF NON-POLICY
VARIABLES IN GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean Expenditure in \$	Variance
1. High	15	7.23	6.55
2. Medium	15	7.44	11.78
3. Low	14	6.42	5.53
Adj. F 1.40	P .261		

Source: Data for central office specialist staff expenditure were calculated from information in Alberta Department of Education Annual Report, 1971 (to be published).

TABLE XXXIII

COMPARISON OF MEAN EXPENDITURE PER PUPIL FOR DIRECT
INSTRUCTIONAL SALARIES IN GROUPS OF SCHOOLS OF
DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Expenditure in \$	Variance
1. High	15	22.41	22.63
2. Medium	15	20.24	45.78
3. Low	14	19.92	34.00
F .79	P .458		

TABLE XXXIV

COMPARISON OF MEAN EXPENDITURE PER PUPIL FOR DIRECT
INSTRUCTIONAL SALARIES ADJUSTED FOR THE EFFECTS
OF NON-POLICY VARIABLES IN GROUPS OF SCHOOLS
OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean Expenditure in \$	Variance
1. High	15	19.96	22.63
2. Medium	15	20.94	45.78
3. Low	14	21.80	34.00
Adj. F .131	P .877		

Source: Data for direct instructional salaries were calculated from information from Alberta Department of Education PPBES Pilot Project, 1971.

Neither is there a significant difference in the mean expenditure for direct instructional salaries for groups of schools of different achievement levels when the means are adjusted for the six significant non-policy variables used in this part of the study. This is indicated by the probability level of 0.877 for the F ratio of .131 obtained for the distribution indicated in Table XXXIV.

X₁₆ (Mean Expenditure for Central Office Administration)

The probability level of 0.007 for the obtained F ratio for the distribution in Table XXXV showed that at least one significant difference occurred between pairs of means of the three groups of schools. There was a significant difference in mean expenditure for central office administration in groups of schools of different achievement levels.

When the effects of the six covariates or uncontrolled non-policy variables were taken into account there are no grounds for asserting that mean expenditure for central office administration were responsible for the differences which we observed in the academic achievement means. The probability level of 0.640 for the adjusted F ratio for the distribution in Table XXXVI showed that there were no significant differences between pairs of means of the three groups of schools once the six non-policy variables used in this part of the study were taken into account.

TABLE XXXV

COMPARISON OF MEAN EXPENDITURE PER PUPIL FOR CENTRAL OFFICE
ADMINISTRATION IN GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Expenditure in \$ per Pupil	Variance
1. High	15	\$20.83	29.17
2. Medium	15	\$23.10	20.31
3. Low	14	\$26.05	2.44
F 5.59	P 0.007		

TABLE XXXVI

COMPARISON OF MEAN EXPENDITURE PER PUPIL FOR CENTRAL OFFICE
ADMINISTRATION ADJUSTED FOR THE EFFECTS OF NON-POLICY
VARIABLES IN GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean Expenditure in \$	Variance
1. High	15	\$22.40	29.17
2. Medium	15	\$23.46	20.31
3. Low	14	\$24.09	2.44
Adj. F 0.452	P 0.640		

Source: Data for central office administration expenditure were calculated from information contained in Alberta Department of Education Annual Report, 1971 (to be published).

X₁₇ (Mean Operational Expenditure Per Pupil Less
Direct Instructional Salaries Per Pupil)

There is no significant difference in the mean or adjusted mean operational salaries per pupil as indicated in the probability level of .932 for the obtained F ratio for the distribution in Table XXXVII and the probability level of .859 for the obtained adjusted F ratio in Table XXXVIII.

X₁₈ (Non-Personnel Mean Expenditures)

The probability level of 0.107 for the obtained F ratio of 2.35 for the distribution in Table XXXIX indicated that there is no significant difference in the mean non-personnel expenditures in groups of schools of different achievement levels. A probability level of 0.158 for the adjusted F ratio of 1.95 was indicated when the mean of the non-personnel expenditures were adjusted for the six significant non-policy variables which are used as covariates in this part of the study, and thus no significant difference in the adjusted means of the non-personnel expenditures when adjusted for the six non-policy control variables (Table XL).

X₁₉ (Grade Nine Pupil Ratio)

There is no significant difference in the mean grade nine teacher-pupil ratio as indicated by the probability level of 0.364 for the F ratio of 1.04 obtained for the distribution in Table XLI. Neither is there a significant difference in the mean grade nine teacher-pupil ratio as

TABLE XXXVII

COMPARISON OF MEAN OPERATIONAL EXPENDITURE PER PUPIL LESS
DIRECT INSTRUCTIONAL SALARIES PER PUPIL IN GROUPS OF
DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Expenditure in \$	Variance
1. High	15	657.71	4088.57
2. Medium	15	649.14	6755.79
3. Low	14	655.08	1476.15
F 0.07	P 0.932		

TABLE XXXVIII

COMPARISON OF MEAN OPERATIONAL EXPENDITURE PER PUPIL LESS
DIRECT INSTRUCTIONAL SALARIES ADJUSTED FOR THE EFFECT
OF NON-POLICY VARIABLES IN GROUPS OF SCHOOLS
OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean Expenditure in \$	Variance
1. High	15	643.91	4088.28
2. Medium	15	659.58	6755.42
3. Low	14	658.67	1475.76
Adj. F 0.153	P 0.859		

Sources: Data for operational expenditures and direct instructional salaries were calculated from information contained in Alberta Department of Education Annual report 1971, (to be published), and Alberta Department of Education PPBES Pilot Project, 1971.

TABLE XXXIX

COMPARISON OF MEAN NON PERSONNEL EXPENDITURE PER PUPIL
IN GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Group Achievement Level	No. of schools in Grp.	Mean Expenditure in \$	Variance
1. High	15	346.78	4469.07
2. Medium	15	379.65	720.64
3. Low	14	341.56	2836.62
F 2.35	P 0.107		

TABLE XL

COMPARISON OF MEAN NON-PERSONNEL EXPENDITURE PER PUPIL
ADJUSTED FOR THE EFFECT OF NON-POLICY VARIABLES
IN GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean Expenditure in \$	Variance
1. High	15	332.24	4468.92
2. Medium	15	370.12	720.59
3. Low	14	367.36	2836.62
Adj. F 1.95	P 0.158		

Source: Data for non-personnel expenditures were calculated from information contained in the Alberta Department of Education Annual Report, 1971 (to be published).

shown by the probability level of 0.198 for the obtained F ratio of 1.03 when the means are adjusted for the six covariates or non-policy variables (Table XLII) which are used in this part of the study.

X₂₀ (Average Grade Nine Class Size)

The probability level of 0.400 is indicated for the obtained F ratio of .94 as shown for the distribution in Table XLIII. There is no significant difference in the grade nine class size in groups of schools of different achievement levels. Similar results are found when the average grade nine class size is adjusted for the six significant non-policy variables which are used as covariates in this part of the study. This is shown by the probability level of .958 for the obtained F ratio of 4.33 (Table XLIV).

X₂₁ (School Pupil Population)

There is no significant difference in the mean of school pupil population in groups of schools of different achievement levels. This is indicated by the probability level of 0.249 for the obtained F ratio of 1.44 for the distribution in Table XLV. The probability level of 0.802 for the adjusted obtained F ratio of .149 showed that there was no significant difference between pairs of means of the three groups of schools when the mean school populations were adjusted for the six covariates used in this part of the study (Table XLVI).

TABLE XLI

COMPARISON OF MEAN PUPIL-TEACHER RATIO IN GROUPS OF SCHOOLS
OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of schools in Grp.	Mean No. of Pupils per Teachers	Variance
1. High	15	21.33	16.81
2. Medium	15	19.87	11.41
3. Low	14	21.64	9.94
F 1.04	P 0.364		

TABLE XLII

COMPARISON OF MEAN PUPIL-TEACHER RATIO ADJUSTED FOR THE
EFFECT OF NON-POLICY VARIABLES IN GROUPS OF SCHOOLS
OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean No. of Pupils per Teacher	Variance
1. High	15	22.18	16.80
2. Medium	15	19.70	11.40
3. Low	14	20.90	9.94
Adj. F 1.03	P 0.198		

Sources: Data for pupil teacher ratio were Calculated from information contained in Alberta Department of Education Annual Report 1971, (to be published) and the Alberta Department of Education PPBES Pilot Project, 1971.

TABLE XLIII

COMPARISON OF MEAN GRADE NINE CLASS SIZE IN GROUPS OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Grade Nine Class Size	Variance
1. High	15	28.07	27.64
2. Medium	15	28.60	23.69
3. Low	14	26.00	35.69
F 0.94	P 0.400		

TABLE XLIV

COMPARISON OF MEAN GRADE NINE CLASS SIZE ADJUSTED FOR THE EFFECT OF NON-POLICY VARIABLES IN GROUPS OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of schools in Grp.	Adjusted Mean Grade Nine Class Size	Variance
1. High	15	28.08	27.63
2. Medium	15	27.59	23.69
3. Low	14	27.07	35.69
Adj. F 4.33	P 0.958		

Source: Data for grade nine class size were calculated from Alberta Department of Education PPBES Pilot Project, 1971.

TABLE XLV

COMPARISON OF MEAN SCHOOL POPULATION IN GROUPS OF SCHOOLS
OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean School Population	Variance
1. High	15	564.67	36839.07
2. Medium	15	554.80	28873.64
3. Low	14	456.50	41410.46
F 1.44	P 0.249		

TABLE XLVI

COMPARISON OF MEAN POPULATION OF SCHOOLS ADJUSTED FOR
THE EFFECT OF NON-POLICY VARIABLES IN GROUPS OF
SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean School Population	Variance
1. High	15	515.87	36838
2. Medium	15	510.43	28873
3. Low	14	556.32	41410
Adj. F 0.149	P 0.862		

Source: Data for school population were derived from the
Alberta Department of Education PPBES Pilot Project
1971.

X₂₂ (Grade Nine Pupil Population in the School)

There is no significant difference in the mean or mean adjusted for the six non-policy variables used in this part of the study of the grade nine pupil population in the schools. The probability level of 0.191 for the obtained F ratio of 1.72 and the probability level of 0.838 for the obtained adjusted F ratio of 1.78 indicated that there were no significant differences between the pairs of means of the three groups of schools when the six non-policy variables are included in the analysis of variance (Table VII). When the non-policy variables are used as covariates in the analysis of covariance (Table XLVII and Table XLVIII).

X₂₃ (Mean Training of Grade Nine Teachers)

The probability level of 0.574 was found for the obtained F ratio 0.56 for the distribution in Table XLIX. No significant difference occurred between the pairs of means of the three groups of schools. When the mean training of grade nine teachers was adjusted for the six non-policy variables used in this part of the study the probability level dropped to 0.130 for the adjusted F ratio of 2.17. This indicated that there were no significant differences in the mean training of teachers for the three groups of schools when the six non-policy covariates were taken into account (Table L).

X₂₄ (Mean Experience of Grade Nine Teachers)

The probability level of 0.015 for the obtained F ratio of 4.64 for the distribution in Table LI indicated that

TABLE XLVII

COMPARISON OF MEAN NUMBER OF GRADE NINE STUDENTS IN GROUPS
OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Number of Grade Nine Students	Variance
1. High	15	66.67	1897.00
2. Medium	15	101.67	4416.38
3. Low	14	75.07	2339.46
F 1.71	P 0.191		

TABLE XLVIII

COMPARISON OF MEAN NUMBER OF GRADE NINE STUDENTS ADJUSTED
FOR THE EFFECT OF NON-POLICY VARIABLES IN GROUPS
OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Groups Achievement Levels	No. of Schools in Grp.	Adjusted Mean No. of Grade Nine Students	Variance
1. High	15	74.76	18.97
2. Medium	15	82.09	44.16
3. Low	14	87.38	23.39
Adj. F 0.178	P 0.838		

Source: The data for number of grade nine teachers were obtained from the Alberta Department of Education PPBES Pilot Project, 1971.

TABLE XLIX

COMPARISON OF MEAN TRAINING OF GRADE NINE TEACHERS IN
GROUPS OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Training of Teachers in Years	Variance
1. High	15	4.00	.14
2. Medium	15	3.82	.55
3. Low	14	4.04	.40
F 0.56	P 0.574		

TABLE L

COMPARISON OF MEAN TRAINING OF GRADE NINE TEACHERS
ADJUSTED FOR THE EFFECT OF NON-POLICY VARIABLES
IN GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean Training of Teachers in Years	Variance
1. High	15	4.04	.14
2. Medium	15	3.74	.55
3. Low	14	4.08	.40
Adj. F 2.17	P 0.130		

Source: The data for training of grade nine teachers were derived from the Alberta Department of Education PPBES Pilot Project, 1971.

at least one significant difference occurred between the pairs of means of the three groups of schools. There was a significant difference between the mean experience of grade nine teachers in the three groups of schools.

However, when the mean experience of the grade nine teachers in the three groups of schools is adjusted for the influence of the six non-policy variables used in this part of the empirical analysis, the probability level increases to 0.974 for the adjusted F ratio of 2.69 obtained. In other words the knowledge of the mean experience of grade nine teachers does not significantly improve the ability to predict the academic achievement of students in groups of schools given the data on the six non-policy variables or covariates (Table LII).

X₂₅ (Number of Courses taught in Grade Nine)

There is no significant difference in the mean number of courses taught in grade nine in groups of schools of different achievement levels. The probability level of 0.99 for the obtained F ratio of 0 for the distribution of Table LIII indicated that there were no significant differences between pairs of means of the three groups of schools. Although the probability level dropped to .455 for the obtained adjusted F ratio of .806, there was no significant difference between the adjusted pairs of means of the number of courses offered were adjusted for the six covariates (Table LIV).

TABLE LI

COMPARISON OF MEAN EXPERIENCE OF GRADE NINE TEACHERS IN
GROUPS OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Teacher Experience in Years	Variance
1. High	15	9.94	12.65
2. Medium	15	7.01	19.17
3. Low	14	5.81	10.59
F 4.64	P 0.015		

TABLE LII

COMPARISON OF MEAN EXPERIENCE OF GRADE NINE TEACHERS
ADJUSTED FOR THE EFFECT OF NON-POLICY VARIABLES
OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean Experience of Teachers in Years	Variance
1. High	15	7.66	12.65
2. Medium	15	7.78	19.17
3. Low	14	7.50	10.59
Adj. F 2.69	P 0.974		

Source: The data for experience of grade nine teachers were derived from the Alberta Department of Education PPBES Pilot Project, 1971.

TABLE LIII

COMPARISON OF MEAN NUMBER OF COURSES TAUGHT IN GRADE NINE IN
GROUPS OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS^a

Group Achievement Level	No. of Schools in Grp.	Mean No. of Courses	Variance
1. High	15	16.40	62.26
2. Medium	15	16.47	22.84
3. Low	14	16.50	30.12
F 0	P .999		

TABLE LIV

COMPARISON OF MEAN NUMBER OF COURSES TAUGHT IN GRADE NINE
ADJUSTED FOR THE EFFECT OF NON-POLICY VARIABLES IN
GROUPS OF SCHOOLS OF DIFFERENT
ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean No. of Courses	Variance
1. High	15	16.64	62.26
2. Medium	15	15.12	22.84
3. Low	14	17.67	30.12
Adj. F .806	P .455		

^aSource: The data for the number of courses taught in grade nine were derived from Alberta Department of Education PPBES Pilot Project, 1971.

X₂₆ (Mean Teacher Turnover Ratio)

There is no significant difference in the mean teacher turnover ratio as indicated by the probability level of 0.510 for the obtained F ratio for the distribution in Table LV when the mean teacher turnover ratio in the three groups of schools is adjusted for the six non-policy variables a probability level of 0.395 for the adjusted F ratio is indicated in Table LVI. There is no significant difference in the mean teacher turnover ratio in the three groups of schools when the means are adjusted for the six covariates used in this study.

X₂₇ (Mean Grade Organization in the School)

The probability level of .831 for the F ratio obtained is for the distribution in Table LVII. This indicated that there were no significant differences between pairs of means of the three groups of schools. A similar result was found when the mean grade organization in the schools was adjusted for the six non-policy variables used in this part of the study. The probability level for the adjusted F ratio of .911 dropped to .412 but there were no significant means of the grade organization in the school adjusted for the six covariates (Table LVIII).

Summary

This chapter has given the findings of the empirical analysis, which involved the investigation of the relationships between academic achievement in grade nine and a number

TABLE LV

COMPARISON OF MEAN TEACHER TURNOVER RATIO IN GROUPS
OF SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean % Teacher-Turnover	Variance
1. High	15	14.8	8.75
2. Medium	15	10.9	3.55
3. Low	14	13.3	14.31
F 0.69	P 0.510		

TABLE LVI

COMPARISON OF MEAN TEACHER TURNOVER RATIO ADJUSTED FOR THE
EFFECT OF NON-POLICY VARIABLES IN GROUPS OF SCHOOLS OF
DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean % Teacher Turnover	Variance
1. High	15	16.71	8.75
2. Medium	15	11.25	3.55
3. Low	14	10.86	14.31
Adj. F 0.96	P 0.395		

Sources: Teacher-turnover ratio data were calculated from Principal's Questionnaire and information provided by Operations Research Branch, Alberta Department of Education.

TABLE LVII

COMPARISON OF MEAN GRADE ORGANIZATION OF GROUPS OF
SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Mean Grade Organization	Variance
1. High	15	2.27	1.63
2. Medium	15	2.33	.952
3. Low	14	2.50	1.04
F 0.18	P 0.831		

TABLE LVIII

COMPARISON OF MEAN GRADE ORGANIZATION ADJUSTED FOR THE
EFFECT OF NON-POLICY VARIABLES OF GROUPS OF
SCHOOLS OF DIFFERENT ACHIEVEMENT LEVELS

Group Achievement Level	No. of Schools in Grp.	Adjusted Mean Grade Organization	Variance
1. High	15	2.27	.164
2. Medium	15	2.33	.952
3. Low	14	2.50	.730
Adj. F 0.911	P 0.412		

Source: Grade organization data were calculated from
Information from the Alberta Department of Education
Annual Report, 1971 (to be published).

of independent variables in a sample of schools in the province of Alberta. The major statistical techniques used for the analysis of the relationships which existed between the dependent variables academic achievement and the independent variables were the one way analysis of variance and the analysis of covariance. The empirical analyses were based on the theoretical distinction between non-policy and policy independent variables. This theoretical distinction guided the selection of variables for the several parts of the analysis.

In the initial part of the analyses, simple correlation coefficients between the independent variables and the dependent variable were shown. The second phase of the analyses concerned the investigation of the relationships between the dependent variable (academic achievement) and all non-policy independent variables. An analysis of variance technique indicated that six of the eight non-policy variables were significant at the 0.05 level or better.

The probability level of 0.05 or better was indicated for X_2 (per cent of pupils of British origin); X_3 (per cent of pupils who are Roman Catholic); X_4 (per cent of pupils who are living in urban areas); X_6 (supplementary requisition as a per cent of total district educational expenditure); X_8 (scholastic ability of grade nine pupils); X_9 (age of grade nine pupils. The independent policy variables); X_5 (equalized assessment per capita); and X_7

(mean family income) were not significant at the 0.05 level for the obtained F ratios. The latter two variables were dropped from the third part of the empirical analysis.

The third part of the empirical analysis concerned the investigation of the relationships between the dependent variable (academic achievement) and all policy independent variables.

The analysis of variance indicated a probability level of significance of 0.05 or better for X_{13} (mean expenditure per pupil for support staff within the school); X_{14} (mean expenditure per grade nine pupil for central office specialist staff); X_{16} (mean expenditure per pupil for central office administration); and X_{24} (number of years experience of grade nine teachers).

An analysis of covariance technique indicated no independent variables which an F test would indicate as being significant at the 0.05 level. In other words, the additional knowledge of the policy variables did not significantly improve the ability to predict academic achievement in groups of schools given the data on the six non-policy variables which were used as covariates in the third part of the analyses.

The empirical analyses of this study has been reported in this chapter in three parts. Following the reportings of the findings in this chapter, the final chapter is devoted to the summary and conclusions of the study.

CHAPTER V

FINDINGS, CONCLUSIONS, IMPLICATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

Introduction

This study has been concerned with an analysis of the relationship between educational expenditure and grade nine academic achievement of a selected sample of 3,576 students in 44 schools in Alberta for the school year 1970-71.

The findings summarized pertain to the major problems, two general problem, and twenty-six sub-problems relating specifically to this study.

An "input-output relationship," which was developed retroductively from the literature was used in the study as a basis for the empirical analysis of this study. The input output relationship classified the variables relating to academic achievement into two major categories: non-policy and policy independent variables. The distinction between the two categories was a logical one based on the ease with which the independent variables were seemingly capable of being manipulated by policy-makers. It was proposed that the independent non-policy variables were less susceptible to manipulation, being essentially immanent characteristics of a school community, and invariant in the short run. In contrast the policy independent variables were proposed as being capable of manipulation, hence, variable in the short

run. This distinction provided a logical basis to separate statistically synonymous variables for the purpose of the empirical analyses.

The statistical analysis employed a one-way analysis of variance technique to indicate the relationship which existed between the dependent variable (academic achievement in grade nine) and eight non-policy independent variables. An analysis of covariance technique was used to indicate the relationship which exists between the dependent variable (academic achievement) and twenty-six independent policy variables when the significant non-policy variables were used as covariates.

This study was therefore, essentially an heuristic study of the relationships between academic achievement and expenditure and the allocation of expenditures within the schools of Alberta. The study marks one of the first Canadian attempts to study expenditure and achievement of schools using achievement as a measure of output.

I. SUMMARY OF THE STUDY

The section follows the sequence of problems which were stated in Chapter I.

Following the general statement of the major problem of this study in question form, there were two major general sub-problems and twenty-six sub-problems, also stated in question form.

The Problem

A general statement of the problem was as follows: What relationship exists between academic achievement as measured by the Alberta grade nine Department of Education tests and selected policy and non-policy variables associated with the expenditures for school operation in a sample of schools in Alberta?

As a consequence of the major problem two general sub-problems and twenty-six sub-problems were investigated.

Sub-Problems Relating to Non-Policy Variables

The first general sub-problem was: What relationship exists between academic achievement as measured by the Alberta Department of Education grade nine tests and certain non-policy variables associated with expenditure with schools?

Nine specific sub-problems were associated with the first general sub-problem. Each of the specific sub-problems involved analytical and computational aspects. The findings appropriate to each sub-problem are summarized directly following the re-statement of the specific sub-problems.

Sub-Problem 1

What relationship existed between academic achievement and the percentage of pupils of British origin? For the selected sample of schools in this study the percentage of pupils of British origin was significantly and positively correlated with mean academic achievement of the pupils. That is, for the schools in the sample, the mean achievement

of the pupils in the three groups of schools increased as the percentage of pupils of British origin increased and the mean achievement of the pupils of other than British origin decreased as the per cent of pupils of other than British origin decreased.

Sub-Problem 2

What relationship existed between academic achievement and the percentage of pupils who are Roman Catholic? The per cent of Roman Catholic pupils had a significant negative correlation with the mean academic achievement of pupils in each of the three groups in this sample. In other words, as the per cent of Roman Catholics in the schools increased, the mean academic achievement decreased.

Sub-Problem 3

What relationship exists between academic achievement and urbanization?

Communities in which the schools in the sample were located were divided into urban areas (10,000 population or over) and non-urban areas. On this basis, analysis of variance showed that the highest achieving group of schools had a mean of 1.27, the medium group had a mean of 1.67 and the lowest achieving group had a mean of 1.64. The Sheffé test indicated that there was a significant difference in the mean urbanization ratios between the highest and middle achieving groups of schools. Inspection of the means of the different groups revealed that as the per cent of schools categorized as urban schools increased, the mean academic achievement decreased.

Sub-Problem 4

What relationship exists between academic achievement and equalized assessment per pupil?

For the selected sample of schools in the present study there were no significant differences among the pairs of means for the three groups of schools classified according to achievement in equalized assessment per capita. The mean equalized assessment in the highest achieving group of schools was \$26.40, in the medium achieving group of schools \$18.66 and in the lowest achieving group of schools \$23.14.

Sub-Problem 5

What relationship exists between academic achievement and mean family income?

For the selected sample of schools in the present study the mean family income was not significantly different in the three groups of schools. This appears to be in contrast with some previous research projects, but some authors, for instance Burkhead et al. (1967) and Thomas (1962) state that mean family income is a much less powerful predictor of educational achievement in small communities. Most of the communities of Alberta would be considered small in relation to communities in previous studies. In addition to this, the structure of the foundations program in Alberta may be an important factor in the conclusion which is found in this section.

Sub-Problem 6

What relationship exists between academic achievement

and the percentage of the total educational budget which is derived from supplementary requisition? For the schools of the sample in this study the per cent of the total educational budget which was derived from supplementary requisition for the three groups of schools, classified according to achievement, was significantly different. That is, for the schools in the sample the mean achievement of the pupils in the three groups of schools increased as the per cent of the total district's educational budget which was derived from the supplementary requisition increased. The amount of the supplementary requisition as a per cent of the districts educational expenditure may be looked upon as a proxy for the districts socio-economic status in Alberta, because it is the per cent of expenditures which is decided upon by the local area. All other expenditures are a function of the foundation program in Alberta. The findings in this section may be interpreted to mean that high socio-economic areas are willing to pay a higher amount of money for education and this socio-economic variable is important in determining differences in school academic achievement.

Sub Problem 7

What relationship exists between academic achievement and the mean scholastic ability of grade nine pupils? With the schools classified into three groups according to achievement, there was a significant difference in the mean scholastic ability of grade nine pupils in the groups of schools selected for this study.

Sub-Problem 8

What is the relationship between academic achievement and the mean age of grade nine pupils? For the selected sample of schools in this study classified according to achievement, grade nine pupils was significantly different. This finding was similar to those of previous researchers for instance, Coleman (1966) and Katzman (1966).

General Sub-Problem Number Two

What relationship exists between academic achievement as measured by the Alberta Department of Education grade nine tests and certain policy variables and the expenditure for school operation in a sample of Alberta schools?

The following eighteen sub-problems were associated with the second general sub-problem. Each of these sub-problems involved certain computational aspects as well as analytical techniques. The findings appropriate to each sub-problem are summarized directly following the re-statement of the specific sub-problem.

SPECIFIC SUB PROBLEMS RELATING TO POLICY VARIABLES

Sub-Problem 9

What relationship exists between academic achievement and the mean salary of grade nine teachers? For the selected sample of schools in this study the mean salary of grade nine teachers was not significantly different with

the mean academic achievement of the pupils. Mean salary ranged from \$9577.13 for the highest achieving group of schools to \$9079.53 for the medium group to \$9580.43 for the lowest achieving group of schools. When these mean salaries for grade nine teachers were adjusted for the six non-policy variables in an analysis of covariance the mean adjusted salaries were \$9330.70, \$9015.38 and \$9910.00 respectively for the high, medium and low achieving schools. No significant correlations were indicated for the adjusted mean teacher salaries.

Sub-Problem 10

What relationship exists between academic achievement and expenditure per grade nine pupil for internal administration?

The mean expenditure for internal administration ranged from \$38.51 in schools categorized as high achieving to \$42.11 in the mid achieving to \$41.32 in low achieving schools. No significant differences in the mean expenditure for internal administration nor in the adjusted mean expenditure for internal administration were found in this study. The adjusted mean expenditures for the 3 groups of schools from high achieving groups to low achieving groups were \$40.29, \$39.06 to \$42.76.

Sub-Problem 11

What relationship exists between academic achievement and expenditure per grade nine pupil for specialist

staff within the school?

The mean expenditure per student for specialist services within each of the three groups of schools was \$18.66, \$24.05 and \$22.62 for the schools categorized as high, medium and low achieving respectively. When adjustments were made for the effect of the non-policy variables the means became \$18.82, \$21.04 and \$25.26 for the schools categorized as high, medium and low achieving. For the selected sample of schools in this study classified according to achievement, neither the mean nor the adjusted mean expenditure for specialist services within the groups of schools was significantly different.

Sub-Problem 12

What relationship exists between mean academic achievement and expenditure per pupil for support staff within the school?

For the selected sample of schools in this study, classified according to academic achievement, the mean expenditure per pupil for support staff is significantly different in the three groups of schools. That is, for the schools in the sample, the mean academic achievement of the pupils in the three groups of schools decreased as the mean expenditure for support staff within the school decreased.

The mean expenditure for support staff within the school increased from \$12.03 in the schools categorized as high achieving to \$17.19 in the medium group to \$19.22 in the group of schools categorized as low achieving.

However, when the mean expenditure for support staff within the school was adjusted for the effect of the non-policy variables used in this part of the study, the adjusted means were \$13.81, \$17.23 and \$17.27 for expenditure for support staff within the three groups of schools. There was no significant difference in the adjusted means for the above distribution.

Sub-Problem 13

What relationship exists between academic achievement and mean expenditure for central office specialist staff?

The means for expenditure for central office specialist staff in the groups of schools were \$5.19, \$7.85 and \$8.17 in the groups categorized as high achieving, medium achieving and low achieving respectively. The comparative means adjusted for the effect of the six non-policy variables were \$7.23, \$7.44 and \$6.42.

The mean expenditures for central office expenditure were significantly different in the three groups of schools classified according to academic achievement, but when the effect of the covariates were taken into account, the significant difference between mean expenditure per pupil for central office expenditure and academic achievement disappeared.

Sub-Problem 14

What relationship exists between academic achievement and direct instructional expenditure per grade nine

pupil?

No significant difference was found between the adjusted mean expenditure for direct instructional salaries and academic achievement. The mean expenditures per grade nine pupil for direct instructional salaries in the three groups of schools were \$22.41, \$20.24 and \$19.92 respectively for the schools categorized as high achieving, medium achieving and low achieving. When the above means were adjusted for the six non-policy variables which were found significant in the second part of the study the comparative adjusted means were \$19.96, \$20.94 and \$21.80 for the high, medium and low groups respectively.

Sub-Problem 15

What relationship exists between academic achievement and mean expenditure per pupil for central office administration?

The probability level of .007 for the mean expenditure per pupil in relation to academic achievement showed that at least one important difference occurred in the means of \$20.83, \$23.10 and \$26.05 for expenditure per pupil for central office administration in the three groups of schools. Academic achievement and expenditure per pupil for central office administration were significantly different in the three groups of schools. When the effect of the six non-policy variables were taken into account the adjusted means became \$22.40, \$23.36 and \$24.09 for expenditure per pupil for

central office administration in the schools categorized as high, medium and low achieving. There was no significant difference between academic achievement and adjusted mean expenditures per pupil for central office administration.

Sub-Problem 16

What relationship exists between academic achievement and operational expenditure per pupil less direct instructional expenditure per pupil?

The mean operational expenditure per pupil less direct instructional expenditure per pupil was \$657.71, \$649.11, and \$655.08 for schools categorized as high, medium and low achieving respectively.

When the above means were adjusted for ethnicity, urbanization, scholastic ability, supplementary requisition as a per cent of total district educational expenditure, religion and age of pupils the means were \$643.91, \$659.58 and \$658.67 respectively for the high, medium and low achieving groups of schools. No significant difference was found in either the mean nor adjusted mean operational expenditure per pupil less direct instructional expenditure per pupil and academic achievement.

Sub-Problem 17

What relationship exists between academic achievement and expenditure per pupil for purposes other than personnel?

No significant relationship was found between mean

nor adjusted non-personnel expenditure and academic achievement for the selected sample of schools in this study.

The mean non-personnel expenditure was \$346.78, \$379.65 and \$341.56 respectively for each of the three groups of schools categorized as high, medium and low achieving.

When the above means were adjusted for the effect of the six significant non-policy variables used in the study, the means became \$332.24, \$370.12 and \$367.36 for the three groups of schools categorized as high, medium and low achieving respectively.

Sub-Problem 18

What relationship exists between academic achievement and pupil-teacher ratio in grade nine?

The mean number of pupils per teacher in each group of schools was 21.33, 19.87 and 21.64 for the schools categorized as high, medium and low achieving. The comparative means adjusted for the six non-policy variables were: 22.18, 19.70 and 20.90. No significant difference was found in either the means nor adjusted mean pupil-teacher ratio and academic achievement in the groups of schools in the selected sample of this study.

Sub Problem 19

What relationship exists between academic achievement and grade nine class size?

The mean grade nine class size in the groups of schools categorized as high, medium, and low achieving were

28.07, 28.60 and 26.00 respectively. The comparative means adjusted for the significant non-policy variables were 28.08 27.59 and 27.07. Neither the mean nor the adjusted mean class size differed significantly among the three groups of schools classified according to academic achievement.

Sub-Problem 20

What relationship exists between academic achievement and school pupil population?

The mean pupil population for the three groups of schools categorized from high achieving to low achieving were 564.67, 554.80 and 456.50. When the above means were adjusted for the significant non-policy variables they were 515.87, 510.43 and 556.32. Neither the mean school population nor the mean adjusted for the six non-policy variables school population differed significantly among the three groups of schools classified according to academic achievement.

Sub-Problem 21

What relationship exists between academic achievement and the grade nine population in the school?

The means and adjusted means for the groups of schools categorized as high, medium and low achieving were: high 66.67 and 74.76; medium 101.67 and 82.09; and low 75.07 and 87.38. The mean grade nine population and academic achievement were not significantly different for neither the mean grade nine population nor the adjusted mean population and academic achievement.

Sub-Problem 22

What relationship exists between academic achievement and the mean training of grade nine teachers?

No significant difference was found in the mean training of teachers and the academic achievement scores of grade nine pupils in the schools selected for this study. Neither was there a significant difference between mean training of teachers adjusted for the significant non-policy variables and academic achievement.

The mean training of teachers in each of the three groups of schools categorized as high, medium and low achieving was 4 years, 3.82 years and 4.04 years respectively. When these means were adjusted for the six significant non-policy variables used in this study, the comparative adjusted means were 4.04, 3.74 and 4.08 years.

Sub-Problem 23

What relationship exists between academic achievement and the number of years of teaching experience of grade nine teachers?

For the selected sample of schools in this study the mean experience of grade nine teachers was significantly different in the three groups of schools classified according to academic achievement.

That is, for the schools in the sample, the mean achievement of the pupils increased as the mean experience of the grade nine teachers increased. The mean experience of teachers in each of the three groups of schools categorized

high, medium and low achieving was 9.64, 7.01 and 5.81 respectively.

When the effect of the six significant non-policy variables used in this study was taken into account, the adjusted means were 7.60, 7.78 and 7.50 years for the high, medium and low groups of schools.

In other words, when the six non-policy variables were taken into account no significant difference was found between academic achievement and experience of teachers in the groups of schools selected for this study.

Sub-Problem 24

What relationship exists between academic achievement and the number of courses taught in grade nine in the school?

No significant difference was found between the number of courses taught in grade nine and grade nine academic achievement. Neither was there any significant difference between the means adjusted for the number of courses for the six non-policy variables and academic achievement. The means and adjusted means of the number of courses taught in the high, medium and low achieving schools were: high, 16.40 and 16.64, medium 16.47 and 15.12, and low 16.50 and 17.67.

Sub-Problem 25

What relationship exists between academic achievement and teacher-turnover ratio in the schools?

The means and means adjusted for six significant

non-policy variables for teacher-turnover ratio in the three groups were: high 14.8 and 16.71 per 100 teachers, medium 10.9 and 11.25 per 100 teachers, and low 13.3 and 10.86 per 100 teachers. No significant difference between mean teacher-turnover ratio nor adjusted mean teacher-turnover ratio and academic achievement were found in the selected sample of schools in this study.

Sub-Problem 26

What relationship exists between academic achievement and the grade organization within the school?

No significant difference was found between the mean grade organization nor the adjusted mean grade organization in the groups of schools selected for the sample in this study. The means of the grade organization and the adjusted means of the grade organization in the three groups of schools categorized as high, medium and low achieving were: high 2.27 and 2.27, medium 2.33 and 2.33, and low 2.50 and 2.50.

There was no significant difference between academic achievement and grade organization. This was true for grades 1-9 as well as for grades 1-12, 7-9, and 9-12 in the selected sample of schools for this study.

GENERAL CONCLUSIONS AND IMPLICATIONS

The general conclusions and implications of this study will be summarized under the following headings:

(1) Non-policy variables and (2) Policy variables.

Non-Policy Variables

The major findings of this study was that the non-policy variables were of the greatest importance in determining the differences in school output as measured by academic achievement. The ethnic origin, religion, amount of the total district educational expenditure raised as local supplementary requisition, scholastic ability, urbanization, and age of grade nine pupils were significantly correlated with academic achievement in the groups of schools selected as the sample for this study. These factors appeared to be the important determinants of variations in academic achievement.

The study shows that many of the factors which educators use in evaluating "quality" of a school can account for very little variation in academic achievement when the background of the students in the schools is controlled.

In a negative sense, it is important to note the non-policy variables which were not discovered as having been significantly correlated with academic achievement in the sample selected for this study. Equalized assessment per capita and mean family income were in this category. However, measures of income in small communities (under 25,000) have not been found to be good proxies of socioeconomic characteristics in previous research (Burkhead et al., 1967:85)

The policy implications of this finding are not particularly pleasant taken at face value; this means that for a large number of low socio-economic children there is no reasonable expectation for an important improvement in the output of education in the immediate future unless something dramatic is done to eliminate the socio-economic conditions of their existences. This may require programs, both public and private which now look nothing short of utopian.

If the existing state of affairs is to be improved it is evident that there must be community programs and school programs to break the existing syndrome of low income --low aspirations--poor education. This is not something which has not been said before, but the present study underscores this problem and suggests that the dimensions of the problem are much more serious than has been commonly understood. The attack on the socio-economic side (non-policy variables) must be undertaken with long-range plans to attack the syndrome noted above.

Policy Variables

The analyses of the policy input variables indicated that when the possible effects of the six significant non-policy variables, or uncontrolled variables, were taken into account no significant differences were found among policy input variables and academic achievement in the selected sample of schools in this study. In other words,

the additional knowledge of the policy variables did not significantly improve the ability to predict academic achievement in the three groups of schools, given the data on ethnic origin, religion, scholastic ability, urbanization, per cent of the total district educational budget raised locally by supplementary requisition and the age of the students.

Teacher's salaries, training and experience do not relate significantly to academic achievement. These traditional measures of teacher quality may need to be more precisely defined to be considered good indicators of quality. The particular attributes of school personnel which have been shown to be statistically related to student achievement do raise questions about conventional concepts of school personnel quality. Coleman (1966) Bowles and Levin (1968) and Hanashek (1968) found the teacher's verbal scores on vocabulary tests to be related rather consistently to pupil achievement. It is important to point out that the teacher's verbal score may be a proxy for a large number of possible cognitive and personal traits of the teacher so that the observed relationship between the teacher's verbal pattern and student achievement may derive from these associated traits rather than the teacher's verbal proficiencies per se.

Thus in spite of the convincing arguments by educators, politicians and some researchers in support of the factors listed as policy variables this study provides no evidence that they are accurate determinants of academic achievement.

The expenditure-performance relationship is surprisingly weak. This study provides no support for the theory that money, itself, represents a good remedy for curing the existing disparities in academic achievement.

No support was found for the popular notion that larger schools perform better than smaller ones. The enrollment variables (size of school, size of grade nine and size of grade nine class) have little explanatory power in the study.

SUGGESTIONS FOR FURTHER RESEARCH

The analysis in this study has dealt with the mean factor scores by schools for the dependent and independent variables with the schools as the unit of analyses. It would be useful to apply similar cross sectional and longitudinal analyses using the pupil as the unit of analyses.

An analysis, similar to this study done in each of the ten provinces would be extremely useful. In addition a similar study with additional measures of output would be an area for further research. Another possible area of research would be a study which would use more refined measures of quality of school inputs. This suggestion is prompted by recent questioning of traditional measures of quality of school inputs such as years of experience and training of teachers.

b.

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APPENDIX A



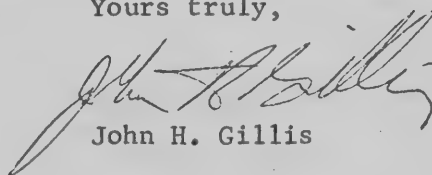
January 18, 1972

Dear

I am a Ph.D. student at the University of Alberta. The topic of my doctoral thesis is "Educational Expenditure and Certain Measures of Academic Achievement in a Sample of Alberta Schools". This Study is being conducted under the supervision of Dr. P.J. Atherton, Department of Educational Administration.

The necessary data for the study is available with the exception of two items of information. I would appreciate it very much if you would complete the enclosed short questionnaire, and return it as soon as possible. All information is strictly confidential and will be used in statistical form for educational purposes only.

Yours truly,



John H. Gillis



January 18, 1972

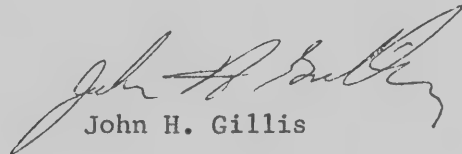
Principal's Questionnaire

School _____

1. What is the approximate ethnic origin of the
grade nine pupils in your school?

- | | |
|---------------------------|---------|
| a) British Isles Origin? | _____ % |
| b) French? | _____ % |
| c) Other European Origin? | _____ % |
| d) Asiatic Origins? | _____ % |
| e) Indian and Eskimo? | _____ % |
| f) Other? | _____ % |

2. How many teachers resigned from your staff
in June, 1971? _____


John H. Gillis

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